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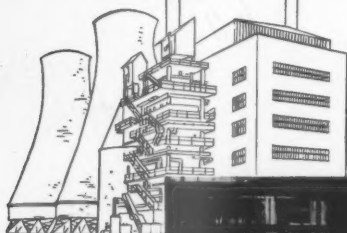
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No. 728

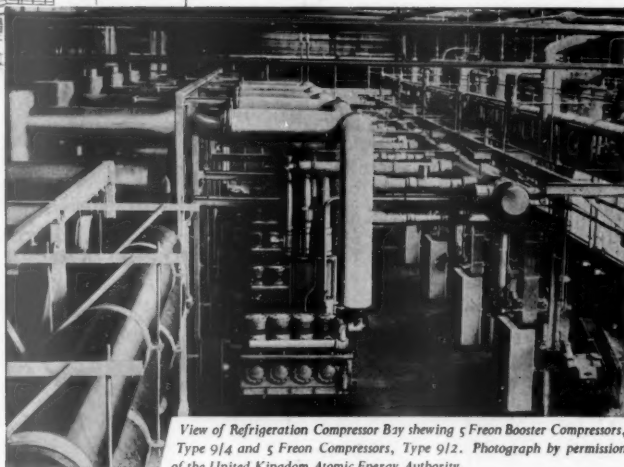
NOVEMBER, 1958

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Refrigeration in industry



Nuclear Research



View of Refrigeration Compressor Bay showing 5 Freon Booster Compressors, Type 9/4 and 5 Freon Compressors, Type 9/2. Photograph by permission of the United Kingdom Atomic Energy Authority.

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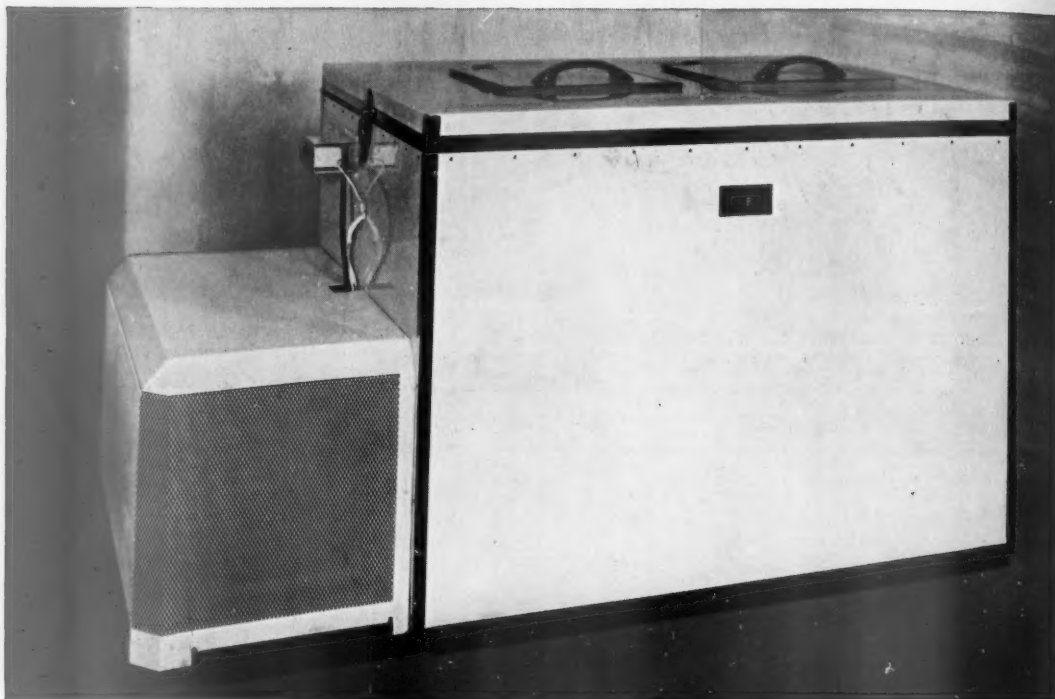
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Hold-over cabinets for conserving ice cream faced with 'Darvic' and made by Alexander Battye (Battifreeze) Ltd., Leeds.

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MODERN REFRIGERATION

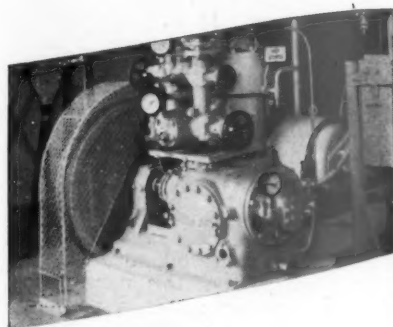
and Air Control News



Incorporating
COLD STORAGE AND PRODUCE
REVIEW
and ICE AND COLD STORAGE
Established 1898

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MODERN REFRIGERATION Overseas

The world-wide circulation of this, the original and oldest Journal of the British Refrigeration Industry, carries "MODERN REFRIGERATION" by postal subscription into the following countries:—

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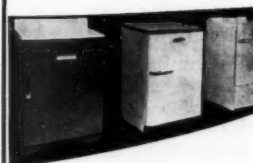
"M.R.", now in its 61st year of publication, has built up for its overseas readers special subscription and sales agencies in all the above territories.

★

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VOLUME 61

NUMBER 728

November . 1958

Editorial

"Never-never" Never Easier

The S. African Market

British Stores praised

● Following the scrapping of all remaining controls on hire purchase, many manufacturing firms up and down the country experienced boom conditions almost "overnight."

● In our endeavour to obtain the reaction of the refrigeration industry to this latest and far-reaching move by the Government, we sought the comments of Mr. A. W. Porter, director and general manager of Frigidaire division of General Motors Ltd., who said: "In September, when hire purchase deposits on household appliances were reduced from 50 per cent. to 33½ per cent., I expressed disappointment that the Chancellor, having made a move in the right direction, could not see his way clear to authorize a more substantial reduction. Now that hire purchase restrictions have been completely lifted I feel I am hardly in a position to express anything but wholehearted relief and pleasure. Of course there is still the question of purchase tax, but having been given some relief in this direction already, we look forward to the day when this last remaining imposition on our industry is lifted. Meanwhile, the last measure should assist in building up the home market, and this in turn—by increasing production—will help us to be more competitive overseas."

● Naturally, retailers of domestic equipment are following their own courses in the matter of deposits on new models but, in certain instances, we have found that, instead of putting down one-third of the price, a housewife can now get delivery of a refrigerator on paying the first quarterly instalment. In the case of a fridge costing £63 3s. 8d. the "take-away" payment will be only £3 3s. 3d. Previously it was £21 1s. 3d. Mr. John Stone, head of the J. & F. Stone chain of electrical shops, is reported as saying: "Our customers will now be able to pay as little as they like as deposit. The first week's instalment will be enough."

● There is no doubt but that home fridge sales will soon reach astronomical heights in this country, due not only to the incentives mentioned above but through the impact of television advertising. This is currently being undertaken by three or four leading makers. Also the appearance of these handsome pieces of equipment in popular

television programmes as prizes causes a widespread desire to own one on the part of many viewers. And members of the food trades also help to boost this desire. For instance, on November 10th, Birds Eye began a "fish fortnight" featuring a consumer competition which should create big interest in the shop and around the quick-frozen food cabinet. Handsome prizes are being offered in the competitions, in which customers will be asked to place in correct order the nine principal advantages of Birds Eye fish products, and write a slogan of not more than 10 words in support of fish fingers. First prize is a Frigidaire 8-c.ft. de luxe refrigerator value 138 gns., while the second prize, a 4-5-c.ft. refrigerator, also de luxe, value 74 gns., is of the same make.

● The current buoyant tone to be found in the domestic refrigerator industry here gave a "crest of the wave" atmosphere to the departure, last month, of a team of Prestcold experts with sales, marketing and engineering knowledge, who left Oxford for the United States. They are now making an extensive tour to study American conditions in all these fields in connexion with products of many types used in the home.

● Although the route of this party had to be switched as a result of the B.O.A.C. strike, the party led by Mr. E. G. Rowledge, senior director, Prestcold Division, will visit a number of cities including New York, Chicago, Detroit, Columbus and Syracuse; and they will visit factories and exhibitions. The travelling party included Messrs. G. W. Nunn, chief engineer; M. R. Harry, market research officer, and M. Horris, domestic sales manager. They were wished a friendly and official farewell by Mr. K. J. R. Cocke, divisional director and general manager, and Mr. T. D. Hinton who has recently joined Prestcold as divisional director and deputy general manager.

● Up-to-the-minute reports on overseas markets are essential to the export-conscious refrigeration makers and it is hoped that the following observations made by a member of this industry to "M.R." will interest readers: "It is, possibly, unwise to endeavour to draw specific inferences after a three-week visit to South Africa, but moving between Johannesburg, Durban, Port Elizabeth and Cape Town and talking to a representative cross-section of the refrigeration trade in that country certain impressions remain which can be commented upon and may be generally interesting," states our informant. "To find so much objectivity and vitality everywhere concerning the future was stimulating. A hard core of realism could be detected which was eager to accept an equal realism on the part of others rather than intangibles. A confident expectation of growth was voiced and

the considerable capital expansion noticed throughout the visit was very obvious proof of this. Undoubtedly when this phase is completed the stage will be largely set for the provision of many ancillary services, refrigeration being one."

● The temper of the South African market is dominated by considerations of price and availability and it is not being extreme to say that unless these two essential aspects are met by manufacturers wishing to export successfully to that market it will largely be waste of time and money in attempting to do so, we are told. Positive competition exists not only in the form of American equipment but in an increasing range of South African produced items and materials. The volume of American equipment is quite considerable and it was perhaps not so surprising in consequence to observe many instances of the individual tending to think and speak in terms of it rather than the British equivalent.

● As to South African production, this at the moment is not really great. It is, however, quite logical to anticipate an increasing scope of activity which could ultimately embrace many of the day-to-day items now being imported. Current production centres mainly around a wide variety of finned evaporators and pipe fittings but this is bound to grow unless imported articles can be marketed in line with the now stringent commercial necessities of price and availability. The attitude seemed to be that if they could not import under such terms then sooner or later they would make for themselves. While possibly prognostic, this is a state of affairs by no means divorced from probability. It should, incidentally, be borne in

mind that the Union Government is an extremely large purchaser directly and indirectly, and will as far as possible tend to accept South African products or equipment to the exclusion of imported goods.

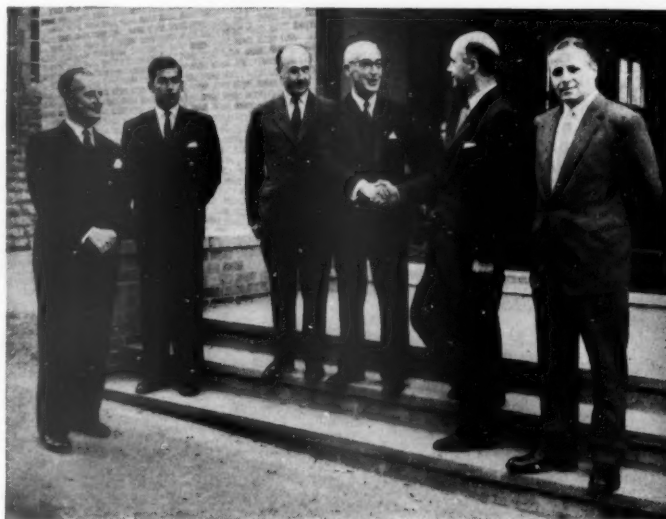
● The standard of insulation and cabinet work seen was impressive. Typical of the up-to-date approach was a fully moulded glass fibre cabinet and advanced designs of display cases in much variety are available at very competitive prices. Finish is excellent with locally produced plastics and stainless steel predominating. It seems likely that display refrigeration will be in considerable demand as the result of legislation, probably now in force, requiring specific standards for the hygienic presentation of foodstuffs. The view was seriously expressed that before long the entire Union's need, in respect of display, deep-freeze and bottle cooling cabinets, could be met by themselves; one cabinet maker was even contemplating the export of his goods. All-in-all, there is every likelihood of an increasing growth of demand in the years ahead much of which must be met by imports. As to who obtains it will largely be decided by the amount of active promotion indulged in and the availability of a truly competitive product.

● A new deal in dentistry is being ushered in, it is reported from the U.S.A., by the use of refrigeration. A refrigerated device (now in experimental production) directs a pin-point stream of cold air on the gums. Gradually the temperature of that jet of air is reduced to the freezing level for dental patients without the inconvenience usually associated with anaesthetics.

FRIDGE PARTY VISITS THE U.S.A.

(See opposite page, col. 2)

The four Prestcold experts visiting the United States being wished a friendly farewell by Mr. K. J. R. Cocke, divisional director and general manager and Mr. T. D. Hinton, divisional director and deputy general manager. The party reading left to right are Messrs. G. W. Nunn, chief engineer; M. R. Harry, market research officer; M. Morris, domestic sales manager and E. G. Rowledge, senior divisional director.



NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During September, 1958, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £556,825 weighing 919 tons, was exported from the United Kingdom. Comparable figures for September, 1957, were 1,186 tons, worth £766,087.

* * *

Exports' Analysis.—Of the 919 tons of air-conditioning and refrigerating plant worth £556,825 exported by Great Britain in September—quoted in the preceding paragraph—33 tons went to the Union of South Africa, 33 tons to India, 35 tons to Australia, 78 tons to New Zealand, 12 tons to Canada, 201 tons to "other Commonwealth countries," 24 tons to Eire, 14 tons to Sweden, 26 tons to Western Germany, 26 tons to the Netherlands, 175 tons to Belgium, 29 tons to France, 13 tons to Italy, and 220 tons to "other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during September, quoted in the first paragraph, commercial refrigerators accounted for 165 tons, worth £73,878, industrial plant and equipment for 350 tons worth £158,854, and parts for all non-automatic refrigerating machinery, for 322 tons, worth £210,032.

* * *

Export of Small Refrigerators.—During September, 978 tons of complete refrigerators (domestic, including complete mechanical units) were sent overseas from Great Britain. These exports were worth £604,696. The 978 tons comprised 98 tons to the Union of South Africa, 26 tons to Rhodesia and Nyasaland, 26 tons to India, 20 tons to New Zealand, 464 tons to "other Commonwealth countries," 5 tons to Sweden, 1 ton to Western Germany, 3 tons to the Netherlands, 31 tons to Belgium, 14 tons to Italy, and 290 tons to "other foreign countries."

* * *

National Poultry Show.—All space allocated to trade stands at this year's National Poultry Show (Olympia, London, December 10 to 12), has been completely sold. This is despite the fact that arrangements had already been made for the entire livestock section to be moved to the galleries of the National Hall to allow for more trade exhibits. Now it has been found necessary to

allocate additional areas in the galleries for stands and to extend the livestock section into the Empire Hall. The world's greatest classic poultry exhibition, the National Poultry Show, is organized annually by *Poultry World* and *The Farmer and Stockbreeder*.

* * *

Special Frozen Foods Consignment.—Recently one of the new Birds Eye 14-ton bulk delivery vehicles carried a special load. The vehicle was brought from Grimsby to London Docks with a



full cargo of Birds Eye fish fingers—well over a quarter of a million individual fingers—for export to the Birds Eye Company in Australia. At the George V Dock the fish fingers were loaded into the refrigerated hold of the 11,000-ton Port Line ship, *Port Hobart*, on the start of a journey which will take some of them to Melbourne and others to Sydney. The *Port Hobart* will travel to Australia via the Cape, covering some 11,800 miles, during which time the fish fingers will remain in her hold and be kept at a sub-zero temperature. The

operation of transferring the fish fingers from the refrigerated vehicle to the ship's hold took less than two hours to accomplish, and during this period a constant check on the temperature of the product was kept by representatives of the freight company responsible for the shipment, to ensure that it never rose above the specific limit.

Cape Town Stores Reinstated.—Building operations which are soon to be completed will give Cape Town a greater fruit-exporting capacity next season than it had before the disastrous fire last January destroyed most of the port's precooling facilities. Ninety-six precooling tunnels are being constructed at the new D berth shed at a cost of £2,250,000 and will have an upper floor capable of holding 7,700 tons of fruit.

Torry Research Station.—The Council for Scientific and Industrial Research announces that responsibility for the research programme of the Torry Research Station at Aberdeen will be vested in a steering committee. The committee will consist of Chairman, Dr. B. K. Blount, c.b. ; Mem-

bers, Mr. G. C. Wilson, O.B.E. ; Dr. D. Traill, B.Sc., F.R.I.C., F.T.I. ; The director of the Torry Research Station and Mr. H. Wooldridge, O.B.E., B.Sc. Their appointment takes effect at once. Dr. B. K. Blount is deputy secretary of the Department of Scientific and Industrial Research. Mr. G. C. Wilson is a member of both the White Fish Authority and the Herring Industry Board. Dr. D. Traill is director of research of the Nobel Division of Imperial Chemical Industries at Stevenston, Ayrshire. Mr. H. Wooldridge will be the representative of H.Q., D.S.I.R., on the committee. He is head of the stations' division. The director of the Torry Research Station is Dr. G. A. Reay. Formerly the title of this post was "superintendent," but it is now changed to "director."

The Accurate Recording Instrument Company have appointed Mr. H. S. Parslow to the company as sales organizer and manager. Mr. Parslow will be responsible for the sales policy of the company and will place the benefit of his very wide experience of the instrument industry at the disposal of all customers both at home and overseas.

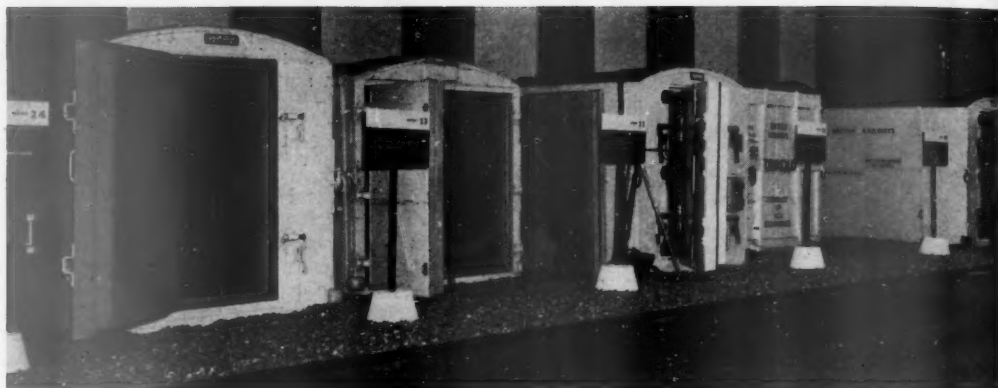
PICTURE OF THE MONTH



The imposing façade of the recently completed Bromborough factory of Kelvinator Limited to which a DoRDec-sponsored visit was paid last month. (See also page 1078).



NOVEMBER 1958



THE TRANSPORT OF PERISHABLE PRODUCE

THE extremely wide range of freight vehicles now being operated by British Railways and British Road Services was on show last month at Battersea Wharf, London.

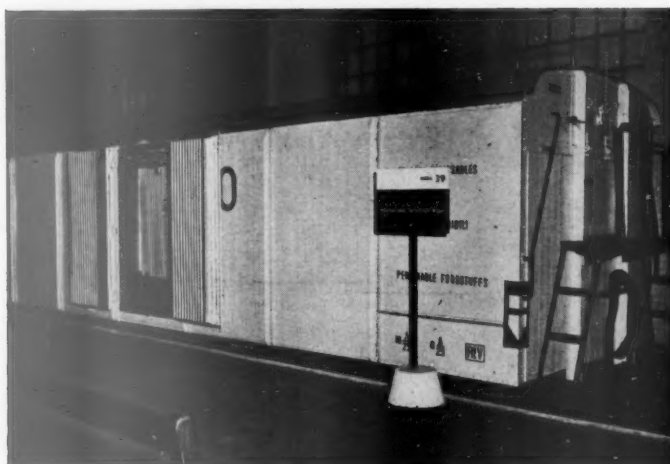
The display entitled "Freight Transport" exhibition was officially opened by the Rt. Hon. Harold Watkinson, M.P., Minister of Transport and Civil Aviation.

The exhibition comprised nearly 60 main exhibits, including a new device for quickly transferring containers between rail and road vehicles; an example of an automatic coupler for railway wagons; representative vehicles of the British Road Services' fleet which ranges from the ubiquitous parcels van to a rigid lorry which can carry over 16 tons, an articulated vehicle which, with a pay-load of 15½ tons, has a maximum

gross weight of 24 tons, and a 24-wheeled trailer designed for big loads of up to 200 tons. There were also examples of almost every type of container, including one which folds up when empty, and can carry 4 tons. They range from 70 to 1,200 c. ft. in capacity and there are types which are adaptable, or are designed for almost every commodity, from meat and frozen foods to bricks.

Mechanical handling equipment of several types, including the British Railways "Freight-lifter," specially developed by British Railways, was also on view.

There are now over 44,000 containers in service on British Railways alone, and thousands more are being produced. They vary from what is virtually an open box, adaptable for the conveyance



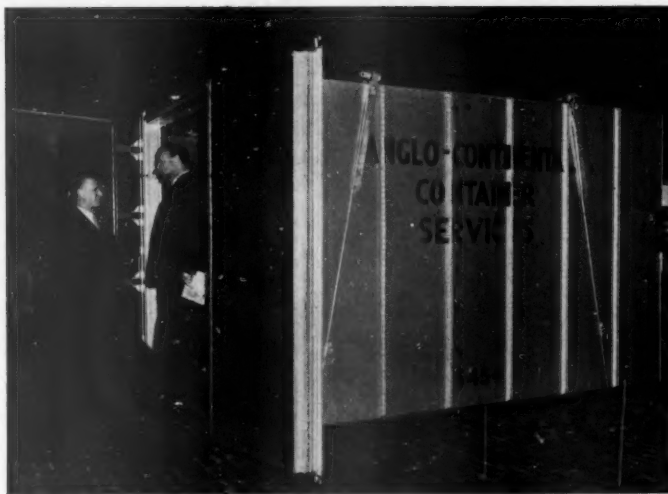
Top: An interesting line-up of road-rail containers.

Left: An Interfrigo insulated rail van.

All "M.R." pictures.

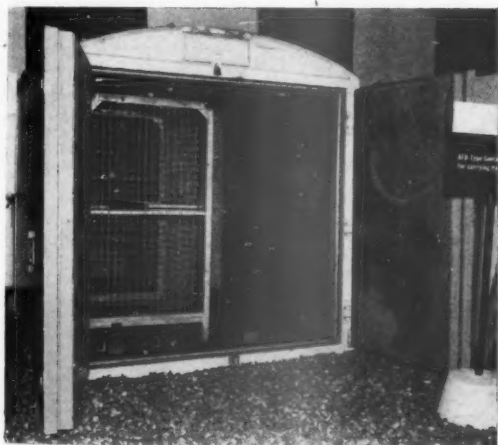
Right: Insulated transportable container for cross-channel work.

Below: Very latest type—the A.F.U. for palletized ice cream and/or frozen foods.



of a wide variety of goods, to specialised highly insulated types for ice-cream and quick-frozen foods. Their sizes range from the large B.R.S. container 24 ft. long, to a B.R. small S.W. type wheeled container that can be pushed by hand.

A wide range of insulated and eutectic-refrigerated containers were on view, one, the AFU, being a newcomer.



The AF-type highly insulated container well known to the trade is designed to carry up to 3 tons of ice cream and frozen foods and other goods where very low temperatures have to be maintained. Insulation is with 9 in. of expanded ebonite; refrigeration is obtained by the use of dry ice which is simple to use. Perishables can

be carried for long distances without deterioration. Commodity temperatures as low as minus 15° F. can be established over a 24-hour transit, but the more usual range is between 5° F. and 10° F.

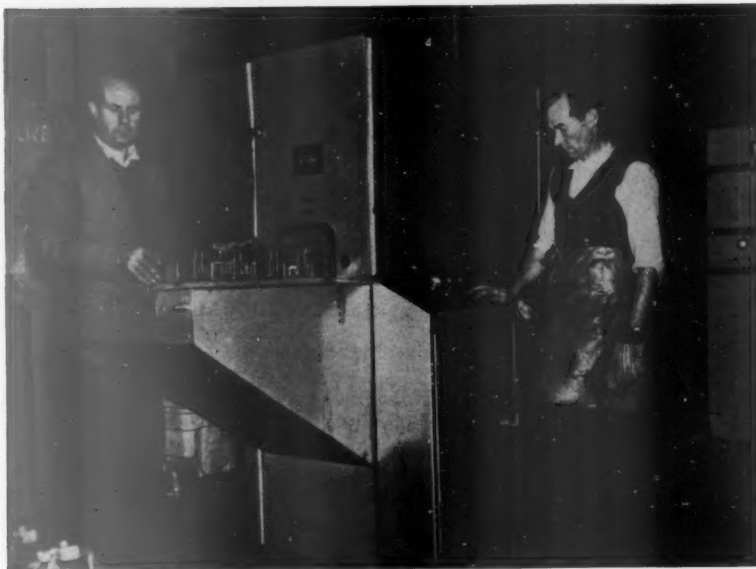
The AFU container, similar to the AF type, is equipped with eutectic plates. These, suspended from the ceiling, are frozen by connecting with a firm's ammonia or "Freon" gas compressor before loading. Temperatures of minus 6° F. or minus 12° F. can be maintained for 48 hours, a comfortable margin for the longest of journeys. About 180 AFUs are in service. This container is shallower than the AF model which enables two of them, instead of one, to be carried on the usual lorry flat platforms.

An outstanding example of the provision of the railway vehicle for the customer is found in the AFU highly insulated pallet container. In it ice cream in wire mesh pallets, four to a load, is conveyed. Loading and unloading are done by fork lift truck through the double doors at one end. Rollers fitted to the floor allow the pallets to be moved easily into position. Fifty-five of these units are under construction. Several of another type for palletized quick-frozen foods are also being built.

For the conveyance of dry ice at a temperature of minus 110° F., the AX container, with 10 in. of insulation, is provided. Of these, 300 are in service, which shows the size of the business.

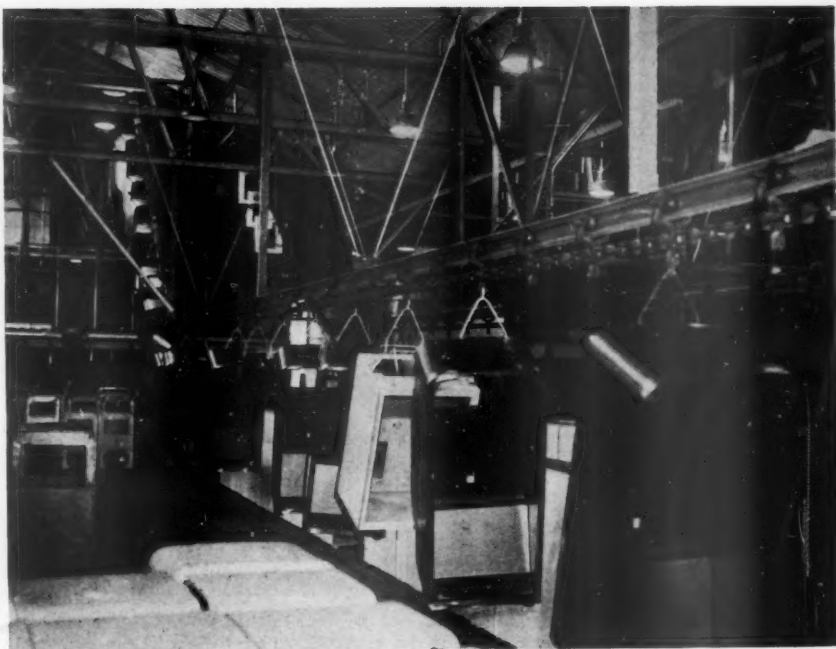
Among the British Road Services equipment for conveying perishable foodstuffs is the small insulated low-temperature box container. It provides a direct link between factory and shop for bacon, pies, sausages and so on in consignments of up to 30 cwt., and saves the need for packing.

KELVINATOR FACTORY INSPECTED



A press facility visit to the new Bromborough factory of Kelvinator Limited was arranged last month by the Domestic Refrigeration Development Committee as part of their nation-wide drive to popularize the household fridge. Visitors were received by Mr. L. N. Griffiths, acting manager, Kelvinator Limited. The programme was arranged by C. S. Services Limited on behalf of DoRDec.

Above : Metal refrigerator parts going through an ultrasonic washer on a conveyor belt in the domestic refrigerator factory of Kelvinator Limited at Bromborough, Cheshire. This factory is the largest ever constructed by the Government for lease to private industry, and has a floor space of 320,000 sq. ft. Kelvinator's are one of the first factories to install this advanced ultrasonic plant.



Right : A picture taken of the overhead assembly conveyor system in the domestic refrigerator factory of Kelvinator Limited.

New Anti-frost-heave System in Frozen Foods Store

AT the new sub-zero store which Birds Eye Foods Limited have built alongside the S.P.D. depot (also under Unilever ownership) at Salfords, Surrey, there are many features which are new to this type of construction; in particular may be mentioned the means for preventing ice formation under the floor.

This new anti-frost-heave method, currently being employed in America, involves passing warm oil under the cold store. The warm oil is pumped from a reservoir in the engine room and is kept at the correct temperature by waste heat from the compressors plus an immersion heater brought in automatically when the former is inadequate.

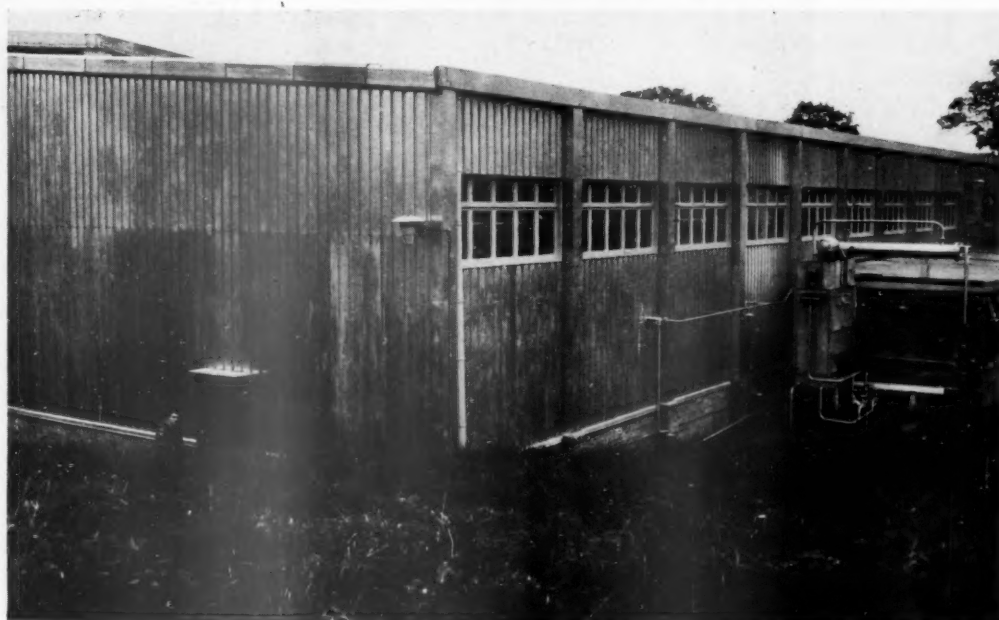
The new store has been designed to hold 600 tons of quick-frozen products contained in a 17-ft. 6-in.-high chamber some 134 ft. long by 50 ft. wide. This chamber has a partition with sliding door installed dividing it into two rooms, one 45,559 c.ft. and the

other 67,700 c.ft., the larger being maintained at -5° F. and the smaller being capable of maintaining a temperature of -20° F. (At the time of "M.R.'s" visit, it was at -28° F.!))

The overall storage area allows for full-scale palletization, three pallets high.

Connected to the 17-ft. 6-in.-high section is a 14-ft.-wide area extending the whole length of the store but only 8 ft. 6 in. high. The forward part of this area is for the bulk assembly of comprehensive stock which is kept topped-up from the main storage area. Since this particular area is completely open to the higher storage room, the temperature is maintained at -5° F. A partition towards the rear of this low section forms a further room at the back of the store which is a break-up room. It is in this room that customers' orders are assembled by a team of operatives for the following day's distribution. The temperature in this room is

A view of the aluminium-clad sub-zero store.





Main door to palletized area and door to bulk assembly and break-up area.



A corner of the
-20°F store.

The -5°F chamber.



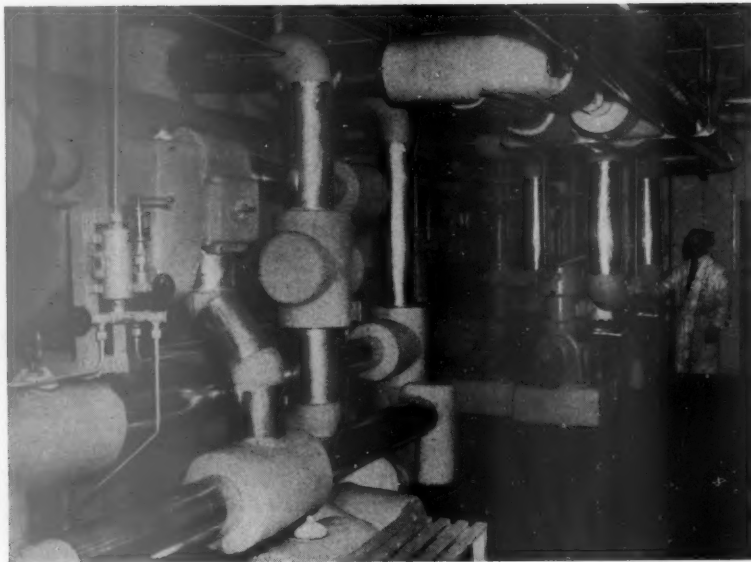
maintained at $+35^{\circ}\text{F}$. and a system of break-up is employed which ensures that the product is moved speedily from the bulk-assembled stock into the break-up room and back out again in the form of customers' orders assembled on trolleys. The trolleys are pushed to the front of the store, still in

the low section, for loading onto vehicles first thing the following morning.

Refrigeration is maintained by five coolers, three for the -5°F . room and two for the -20°F . room, situated over the low section and feeding ducting which distributes the refrigerated air throughout the



First floor corridor showing, on the right, the five evaporator housings.



Left: The refrigerating engine room showing the neat appearance achieved by the use of duralumin sheathing on the piping.

Below: The temperature indicating panel.

cold store, i.e. the refrigeration is by the forced draught method.

The above layout thus enabled Birds Eye Foods Limited to construct a cold store without waste of storage space, yet capable of full-scale palletization and low height working necessary for the breaking up of customers' orders and distribution. The roof trusses cover the full width of the cold store and the low section area plus coolers, thus making a total external width of 65 ft. 8 in.

The bulk assembly area has a capacity of 15,530 c.ft. and the break-up room has a capacity of 5,023 c.ft.

Two \times 25-h.p. ammonia compressors supply the refrigeration capacity for the five coolers and the latter are defrosted regularly by hot gas. This is arranged through valve adjustments carried out by the resident engineer.

The temperature in the break-up room is maintained by a system of ducting in which a fan, operating continuously, is installed. Thermostats either switch on heaters within the ducting thus warming the air, or switch off the heaters and open up louvres to the -5° F. section, thus cooling the air. The combination of these two operations ensures maintenance of temperature and a change of fresh air within the break-up room.

The compressor equipment is automatically cut in and out by controllers which are related to resistance thermometers installed in strategic positions in the cold store.

Adjacent to the engine room is a small office for the engineer in which an instrument panel provides

him with the temperatures of any part of the cold store, assembly area, break-up room or underneath the cold store, by manipulation of the corresponding switch.

Access to the cold store is by means of a main door for the palletized area, with a personnel door adjacent, and a main door for the bulk assembly and break-up area, again with a personnel door adjacent. The two main doors are provided with airveils but rubber swing doors have been added at the large main door entrance to the palletized section to give



assistance to the airveil since the site is more open than originally conceived.

Insulation of the ceiling of the store is 6 in. of expanded polystyrene and a further 4 in. of cork and the insulation of the walls and floor is 10 in. of cork; the last 2 in. of insulation throughout are grooved for the Minikay dehydration system, which is included in this installation. Two Minikay dehydrators are installed in the upper section with the coolers and this section is accessible by steps leading up from the outside of the cold store. The coolers are contained in insulated houses with super-freeze doors for access.

The Minikay system consists of a plant for drying air and circulating this dry air through grooves formed inside the insulation all round the cold store. The air is dried by passing it over a finned tube cooling coil so that it is cooled to a temperature slightly below the store operating temperature. This air is then conveyed in metal ducting to various points in the cold store from which it is permitted to circulate through the grooved cork towards the second set of ducting for collecting the air and returning it for drying. During its passage through the cork, the air is warmed slightly due to the natural passage of heat from the ambient. It therefore has the power to take up moisture.

The engine room is situated adjacent to and along one side of the cold store.

The main construction is similar to the new cold stores currently being built by Birds Eye, i.e., aluminium outer cladding with two layers of asbestos fire proofing and insulation as quoted above, and already described in these columns.

Emergency doors at the rear of the cold store are positioned in the main storage area and in the break-up area.

Responsibilities

| | |
|---|--|
| General design, co-ordination and progressing of work | Birds Eye Foods Ltd., cold storage dept. |
| Insulation, cold store construction, engine room fabric | Smiths Insulations Ltd. |
| Refrigeration | The Lightfoot Refrigeration Co. Ltd. |
| Dehydration System | Minikay Ltd. |
| Electrical | Unilever TD/Eng./Elect. & J. H. Plant Ltd. |
| Foundations and Local Authority approvals | S.P.D. Ltd., planning dept. Frederick S. Snow & Partners, and County Construction Company. |
| Instruments | Unilever TD/Eng./I. & C. |
| Temperature - Indicating panel | The Foster Instrument Co. Ltd. |

International News

Libya

The Board of Trade has been advised by the British Embassy at Tripoli that the Ministry of National Economy, in collaboration with the Libyan American Reconstruction Commission, has approved a project for the construction of two large refrigeration plants for the storage of meat, fruit and vegetables to be erected at Tripoli and Benghazi harbours. Tenders for the refrigeration equipment are to be put out to international tender in the near future. These projects are the result of a recent decision to increase the export of meat, fruit and vegetables and are designed to provide the necessary storage facilities at the two ports.

New Zealand

The United Kingdom trade commissioner at Wellington has received complaints from New Zealand firms that, in comparison with other countries, some United Kingdom firms are dilatory in answering correspondence. The trade commissioner emphasizes that United Kingdom exporters may be putting themselves at a disadvantage in relation to their competitors—particularly Australia—if they are not prompt in sending replies to correspondence from New Zealand firms.

South Africa

The Board of Trade states that in their note, GEN/4248,

of July 1, they said that the United Kingdom trade commissioner, Pretoria, had drawn attention to the desirability of United Kingdom firms persuading their Johannesburg agents to visit the Northern Transvaal towns. An extract was also given from a report he had prepared on a brief visit to the area. He has now pointed out that the extract omitted details of the population of the towns referred to which would help to keep the picture in proper perspective. Thus the population of Pietersburg is 8,100 white and Potgietersrus, 3,800 whites. Since the report was submitted it has also become apparent that in some trades, some of the wholesalers in the area (none of whom are large) may not necessarily be suitable direct contacts for United Kingdom exporters or their representatives. Indeed some wholesalers in the Johannesburg area have traditionally supplied the wholesalers in smaller towns and in some cases direct approaches by manufacturers' representatives to these wholesalers might not be worth-while. Further, leading wholesalers in Johannesburg who operate a system of central buying have their own depots in the Northern Transvaal.

Venezuela

H. M. Embassy in Caracas has been approached by Dr. Luis H. Ball, (Apartado 714, Caracas) the assistant

manager of Laboratories Biogen, C.A., who plans to establish a permanent exhibition of British goods in Caracas, as a commercial undertaking. Dr. Ball feels that in view of the marked increase in the numbers and purchasing power of the Venezuelan population since the war, the United Kingdom should be able to obtain a better share of the Venezuelan market, particularly in consumer and luxury goods. He points out, and this is confirmed by H.M. Embassy, that a Swedish exhibition run on similar lines to the one he envisages, although of a more limited character, has been a great success. His proposal is to form a company which would stage, in suitable premises, a permanent exhibition containing examples of the whole range of British goods. The exhibition would probably begin with good-class consumer and luxury goods but would be extended to machinery and other industrial products later. The exhibition itself would not hold big stocks but would probably act as a kind of mail-order house for orders received on the basis of samples seen there. Sales would also be made direct to the public.

Pakistan

The United Kingdom trade commissioner at Dacca has informed us that Mr. K. R. Khan, dairy and cattle adviser, Government of East Pakistan P.O. Tajgaon, Dacca, wishes to purchase certain dairy equipment, e.g. pasteurisers, milk storage vats, cream separators, cold boxes for butter, milk cans, butter churners, butter workers, etc., but before he can do this it is necessary for him to provide precise details and the prices C. & F. Chittagong to the Pakistan Department of Supply and Development. As he is anxious to go ahead with this scheme as quickly as possible, he would like to receive full details of their products from United Kingdom manufacturers, of the dairy equipment he requires. Manufacturers interested in this enquiry should write direct to Mr. Khan. It would be appreciated if, at the same time, they would copy their initial correspondence to the United Kingdom trade commissioner, Adamjee Court, Motijheel, P.O. Box No. 90, Ramna, Dacca, East Pakistan.

Cuba

An exhibition of British products will be held in the Sports Palace in Havana from December 2 to 5. Motor vehicles will constitute about three-quarters of the exhibition; most of the remainder of the space available has already been booked. Other exhibits will include agricultural machinery, Scotch whisky and Irish linen. Arrangements for the exhibition are being made by a local committee which includes representatives of the British Chamber of Commerce in Cuba, motor car and machinery importers and the British Embassy. For further details interested manufacturers and exporters are advised to get in touch with their agents in Cuba. Firms who have no representation should write to the British Embassy, Apartado 1069, Havana, Cuba.

Pakistan

The United Kingdom trade commissioner at Karachi has informed the Board of Trade that a number of United Kingdom firms are sending letters to firms in Pakistan but have been ending the address with the word "India." Although it may seem a matter of small importance the trade commissioner has pointed out that it does in fact create considerable ill-feeling, and loss of goodwill. United Kingdom firms are, therefore, requested in their own interest to make sure that letters to firms in Pakistan are correctly addressed.

The United Kingdom trade commissioner at Karachi

has also reported that defence purchasing by the Pakistan Government has now been split into two organizations under the control of a director-general of defence purchases, Niaz Ahmad. D.D.P. I continues to be responsible for the procurement of warlike stores, and D.D.P. II deals with the procurement of non-warlike stores for the armed services and the Pakistan ordnance factories, including procurement formerly dealt with by the director-general of supplies and the textile commissioner. D.D.P. II will undertake also all disposal work pertaining to the defence services and the ordnance factories.

Portuguese East Africa

Messrs. Boror Comercial, Caixa Postal 4, Lourenco Marques, have informed the British consulate-general at Lourenco Marques that they are interested in obtaining the exclusive representation of a United Kingdom manufacturer of portable, house unit air-conditioners. Messrs. Boror Comercial have extensive and varied interests in Portuguese East Africa. They have branch offices throughout the territory and deal both in the import and export of merchandise. They also have a department who specialize in tendering for Government contracts. The company own large coconut plantations and other agricultural estates. The Portuguese concern are considered to be a suitable connection for United Kingdom firms. Manufacturers interested in this agency enquiry should write direct to Messrs. Boror Comercial. It would be appreciated if, at the same time, they would notify the British consulate-general, 62, Avenida Elias Garcia (P.O. Box 55), Lourenco Marques, that they have done so.

Mexico

Mexico is that part of North America lying immediately south of the United States of America. It has an area of 760,000 square miles and a population of approximately 31,500,000 (growing by $3\frac{1}{2}$ per cent a year) of which about 4,500,000 are concentrated in Mexico City and the Federal District. A market report on dairy plant and machinery has been prepared by the Board of Trade. As an indication of the potential market which exists in Mexico for dairy plant and equipment it is reported that the present production of milk throughout the country is estimated at between 4,000,000 and 5,000,000 litres per day, of which only just over 1,000,000 are pasteurized or treated in some manner. Until the year 1951 when the Ley de Pasteurizacion (as it is commonly known) was promulgated, milk and milk products were handled by primitive or old-fashioned methods, but since then more and more importance is being given to modern standards of hygienic milk-handling and Mexico can, therefore, be considered amongst the promising markets for dairy plant and equipment. There is some local manufacture of small scale, of the simpler items of equipment, utensils, etc. Items for which there is a good market but which are being supplied by other countries are: cream-separators (Germany), butter churns (Denmark and Holland), ice-cream mixers, pasteurizers, freezers, etc., (U.S.A.), homogenizers and emulsifiers (U.S.A.). There is a limited market for: churn-washers and steamers, coolers for milk (this can be developed) and evaporating pans. Finally there is no market for the following which are manufactured locally: tanks for various purposes, sterilizing chests, bulk transport tanks, cheese vats and presses and tinfoil for bottle closures. There is also no demand for crate and case washers. The refrigeration equipment which has been installed in the town dairy installations which have been put up in Mexico has invariably been of U.S.A. manufacture, since several well-known United States names dominate the refrigeration market in Mexico.

REFRIGERATION STANDS AT THE 1958 DAIRY SHOW



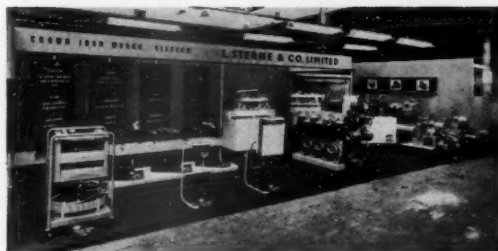
J. & E. Hall Limited.



Loheat Limited.



Prestcold Division of Pressed Steel Co. Ltd.



L. Sterne & Co. Ltd.



J. Samuel White & Co. Ltd.

New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

Loughborough Cold Storage Co. Ltd., 64, West Smithfield, E.C.1. Secretary: W. J. Middlemiss. Capital: £1,000. Directors: Richard A. Wood, F.C.A., "Bramall," Faircrouch Road, Wadhurst; Ronald F. Penney, A.C.A., 94, Conway Road, N.14. Sussex. Registered by F. S. Moore, Ltd.

Bennix Insulated Ltd., 19-23, Oxford Street, W.1. To carry on the business of importers, exporters and manufacturers of and dealers in air-conditioning equipment, etc. Capital: £100. Directors to be appointed by the subscribers. Subscribers: Kathleen M. Clark, 33, Medway Street, S.W.1.; Sylvia F. Ashman, 1, Appach Road, S.W.2. Registered by Solicitors, Anthony Leader & Co., W.1.

Vidrex Air-Conditioning Co. Ltd., 1,180, Chester Road, Stretford, Manchester. Secretary: S. Causey. Capital: £1,000. Directors: Samuel Causey, 49, Derbyshire Road, South, Sale, Ches.; Harold W. Earle, 15, Rowood Avenue, Manchester, 8. Registered by Lewis Coates and Lucas Ltd.

Refrigeration Sales Co. (Liverpool) Ltd., 549, West Derby Road, Liverpool, 13. Secretary: Austin R. Huxley. To carry on business of manufacturers of and dealers in refrigerators and cold storage machinery, etc. Capital: £100. Directors: Austin R. Huxley, 38, Lancaster Road, Birkdale, Southport; Donald Low, 41, Lynwood Gardens, Liverpool, 9. Registered by H. T. Woodrow & Co. Ltd.

Refrigeration Controls—II

THERMOSTATIC TYPES

By H. H. EGGINTON

(Continued from October issue)

THERMOSTATIC EXPANSION VALVES

THE object of a thermostatic expansion valve is to meter refrigerant into an evaporator, sensing both temperature and pressure conditions, such that the amount of liquid metered is in exact proportion to the rate of evaporation of the liquid refrigerant in the evaporator. This in turn is a relationship of the heat load and the capacity of the compressor under the given conditions. The valve is deliberately set so that the vapour leaving the evaporator is superheated, *i.e.* no wet vapour or liquid can enter the compressor which might cause damage on the compression stroke of the compressor.

A vapour at a given pressure, but having a temperature higher than at saturation temperature for that pressure, is said to be superheated. In simpler words, if a vapour has a temperature higher than it should have according to the vapour pressure curve, it is superheated. The amount by which it is higher can be expressed in °F. superheat, *e.g.* if Refrigerant-12 is sealed in a container with wet vapour or liquid present and its pressure is 49 p.s.i. gauge, its temperature would be 52° F. because this is the saturation temperature corresponding to the pressure. If, however, the pressure remained at 49 p.s.i. and the temperature was 62° F., then there would be no liquid or wet vapour, and the vapour would be superheated by 10° F.

The capacity of thermostatic expansion valves is expressed in B.t.u. per hour and is a function of the valve orifice size and discharge coefficient, the pressure and temperature system rate (*i.e.* the amount of valve movement per unit of evaporator pressure change per °F. of phial temperature change) and the temperature and pressure of the liquid and vapour on each side of the valve. It will be quite apparent, therefore, that comparing valves by orifice size alone is not reliable.

Most manufacturers give tables of capacity based on evaporating and condensing conditions for a given refrigerant based on an allowed variation of evaporator superheat of 4° F. This being the temperature change at the phial which will

take the valve from closed to open to rated capacity. Valves will pass more refrigerant if the superheat change is increased, and in fact some capacities are based on 7° F change in superheat, which represents a greater swing in evaporator conditions, which may or may not be acceptable.

Principal Requirements

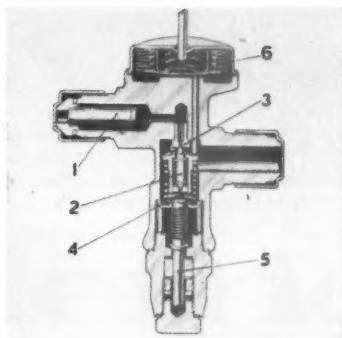
- (1) The valve construction and design should be such that it does not become erratic by reason of varying pressures and temperatures in its working and storage temperature range and the mechanism should not be susceptible to blockage by oil at refrigeration temperatures.
- (2) The valve seat area on which the condensing pressure is operative should be small in relation to the prime mover area on which the evaporator and thermal pressure operate. If this is not so, change in condensing pressure will alter the response of the valve. In small orifice valves this out-of-balance force due to variation in condensing pressures is small enough to be ignored; on medium size valves it can be allowed to reach about 1 lb., and on large valves is overcome by the use of doubt beat valves. This factor can become significant on low temperature valves, working at low evaporator pressure where pressure changes can represent considerable variation in superheat setting.
- (3) The valve should have a low hysteresis and should certainly be capable of changing direction of movement with a pressure change of not more than 1 p.s.i. Valves working at low temperatures, *e.g.* 15 in. mercury vacuum or lower, may demand for sensitive control a hysteresis of not more than 0.5 in. mercury.
- (4) The valve mechanism must have good shut-off characteristics so that when the compressor stops leak of refrigerant to the evaporator does not occur.
- (5) Two principal types of valves are normally required, those operating over long thermal ranges and those which only operate below certain evaporator pressure and superheat

conditions. These characteristics will be fully described later in the article.

Constructional Details

Constructional details vary little from one manufactured type of thermostatic expansion valve to another, except where special duties are involved. For all valves, excluding ammonia, it is common to have forged brass bodies with stainless steel needle and seat orifices or agate and plastic, and brass bellows or stainless steel diaphragms.

Ammonia-type valves replace the non-ferrous alloys with cast-iron, steel or stainless steel construction, with the exception of monel, which is sometimes used for seats and diaphragms. As with constant pressure valves, secondary orifices in the outlet of the valve are used to reduce the pressure drop across the controlling needle and orifice and to suppress icing and the separation of wax, as well as reducing wear by erosion of the needle and orifice.



by courtesy of Teddington Refrigeration Controls Ltd.

Fig. 37.—Typical thermostatic expansion valve

- | | |
|-----------------|-------------------------|
| 1. Filter | 4. Range spring |
| 2. Valve needle | 5. Superheat adjustment |
| 3. Valve seat | 6. Sensitive bellows |

The type of pipe fitting varies very largely with the size of valve, which bears some relation to the pipe diameter. Up to $\frac{1}{2}$ -in. diameter flare fittings are usual, but above this sweat and flange connections are used.

It is essential that provision is made in the construction for a filter or strainer on the inlet or liquid side of the valve. Such a filter or strainer should be approximately 100 mesh and large enough in area to avoid pressure drop. This protection against harmful particles getting

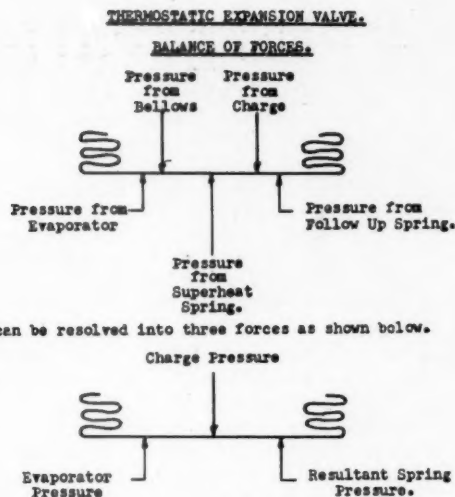


Fig. 38.

in the valve should be used, irrespective of any other strainer or filter in the plant system.

Operating Characteristics

The prime mover of the valve is fitted with a length of capillary and a phial and charged as previously described, with liquid, gas or adsorber charge, such that temperature changes at the phial give rise to pressure changes which move the bellows and open or close the valve. The space around the outside of the bellows is at evaporator pressure trying to push the bellows up and close the valve, and in addition, a superheat spring and possibly a follow-up spring, behind the needle, exert upward pressures. The purpose of the follow-up spring is to keep the needle in contact with the push rod and finally hold the needle on its seat. Sometimes the superheat spring is made to perform both these functions (see fig. 37). The balance of forces acting around the bellows can be seen in fig. 38. For the purposes of illustration the out-of-balance thrust on the needle area has been ignored.

In order to ensure that as much as possible of the evaporator surface is being used to boil off liquid refrigerant, the thermostatic expansion valve is made to regulate the quantity of refrigerant passing into the evaporator so that at a point on the suction line after it has left the evaporator it is a superheated vapour at a certain temperature.

Referring back to the balance diagram (fig. 38) it can be seen that in order for the bellows to move forward and open the valve the pressure above

the bellows has to overcome the evaporator pressure and spring pressure and the only way to raise this pressure is to warm the phial to a temperature above the evaporating temperature. As the phial is strapped to the suction line the refrigerant passing under it must be superheated in order to do this. If the superheat increases, it opens the valve so that more liquid refrigerant is admitted and as this cannot be completely vaporized in the evaporator it cools the phial and makes the valve close a little and reduce the flow of refrigerant. If the valve admits less refrigerant than is required, the refrigerant quickly boils off, picking up superheat and opening the valve to increase the flow. While a valve is working, the superheat varies from one condition to the other and a steady and limited hunting takes place.

The superheat at which valves are set is called the closed superheat because the needle is on its seat but just about to open. This is generally 10°F. at a certain evaporator temperature (standard valves are usually set at 10°F. superheat on 10°F. evaporator temperature) but for rating purposes the superheat must be increased to open the valve. Valve capacities are generally given for the opening after the phial has been warmed to a further 4°F. The operating or open superheat of the valve is therefore 14°F. when the closed superheat is 10°F. If the closed superheat would

remain at 10°F. over the whole range of the valve matters would be considerably simplified but, except in certain circumstances, this superheat will vary over the whole operating range.

When a refrigeration plant is started up at ambient temperature, the evaporated refrigerant is comparatively dense and the compressor will pump quite a large mass around the circuit. The valve has to open sufficiently to allow this increased flow to take place so at start a fairly high difference between closed and open superheat will occur and under these conditions the capacity of the valve will be greater than the rating. In a correctly sized valve the difference between open and closed superheat will be 4°F. at the evaporator temperature where the thermostatic or pressure operated switch stops the motor.

There are a number of different ways of charging a valve in order to obtain certain characteristics and these can be summarized as follows:—

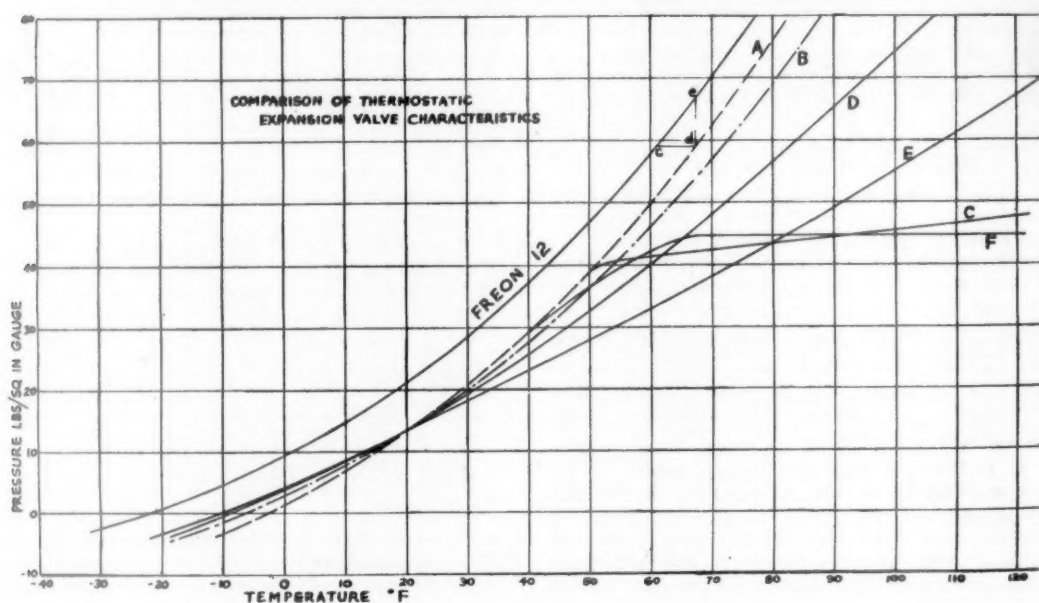
- (a) Liquid charge.
- (b) Gas charge.
- (c) Adsorption charge.

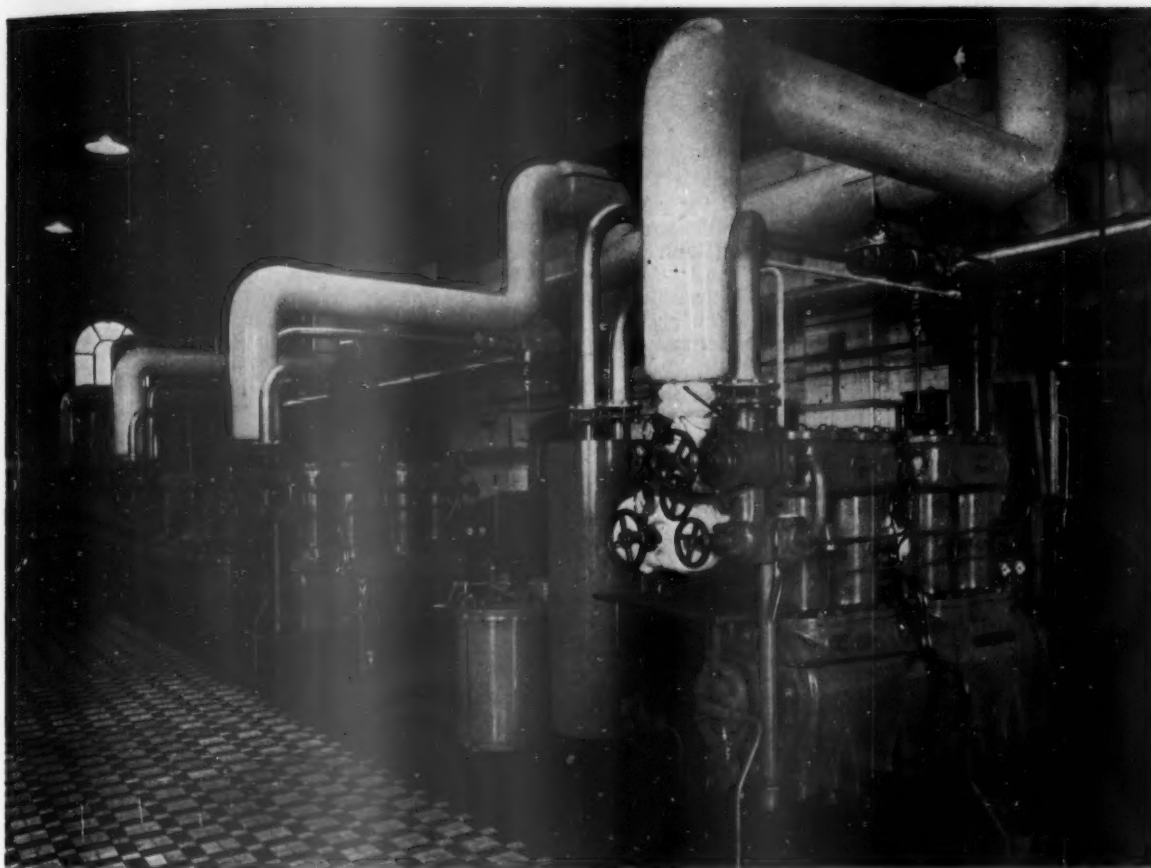
The liquid and gas charged valves can be further sub-divided into two types:—

- (a) Straight charge.
- (b) Cross charge.

Considering these items individually:—

Fig. 39.—Showing variation of superheat in terms of temperature and pressure, e.g., c-d and d-e respectively, for different types of charge, against a given refrigerant at a variety of evaporator temperatures.





Refrigeration

Refrigerating compressors of the monobloc type are widely used in the manufacture and storage of foodstuffs. This installation comprises four 8' x 8" quad and an 8' x 8" twin monobloc compressor, driven by a total of 675 h.p., and have an installed capacity of 6½ million B.t.u. per hour. It is installed at the margarine plant of the Co-operative Wholesale Society at Irlam, Manchester. The equipment manufactured by J. & E. Hall ranges from small refrigerated cabinets and compressors of ¼ h.p. to centrifugal compressors of the largest size in use today.



J. & E. HALL
LIMITED
DARTFORD • KENT

AP 203

(a) *Liquid Charge* (fig. 39, curves A & B).

In this case the thermal system has a phial whose volume is such that it will hold the whole of the charge and the common liquid vapour surface remains in the phial. In addition the volume of the bellows and capillary must be less than the volume of the charge so that, if the bellows becomes colder than the phial and the charge reverses, the common surface which controls the pressure still remains in the phial.

A liquid-charged valve will commence to operate as soon as the plant is switched on and a quick pull-down results; it is not affected by charge reversal. Disadvantages are that a larger motor may have to be fitted to cope with this initial load and the difference in pressure between thermal system and evaporator remains equal to the upward pressure of the spring at all temperatures. At high temperatures the refrigerant can leak past the valve seat due to slight differences in temperature between the phial and the bulk of the evaporator, and be worsened by a fine superheat condition. Sometimes a magnetic valve is fitted to deal with this problem.

(b) *Gas Charge* (fig. 39, curve C).

If the thermal system is charged with a limited quantity of refrigerant the vapour pressure temperature relationship holds good so long as liquid is present. As soon as all the liquid in the phial has been evaporated and only vapour is present a large increase in temperature will give rise to only a small increase in pressure. The valve is charged with vapour at a certain temperature or pressure so that liquid forms when the phial temperature reaches a certain predetermined value.

If the balance diagram (fig. 38) is referred to it will be seen that if the pressure of the thermal systems stops rising at a certain phial temperature an increase of evaporator temperature will tend to keep the valve shut and, in fact, the valve will remain closed always unless the evaporator pressure and hence temperature, falls below a certain value.

The fact that the valve does not commence to operate until a certain evaporator pressure is reached is useful because it means that the load on the motor during the early stages of pull down is reduced and a less powerful motor is demanded. The great disadvantage of this type of valve is that the charge can reverse so it is important that no part of the thermal system becomes colder than the phial. If the capillary is allowed to touch the evaporator the valve will control the superheat at that point and if the bellows becomes the coldest part the valve will remain shut until the evaporator pressure below the bellows is reduced to a value below the pressure in the bellows by an amount

which will overcome the superheat spring thrust.

This tendency for reversal is counteracted by fitting the valve outside the refrigerated space wherever possible, and by passing the hot high side liquid entering the valve around a gallery below the bellows to warm the head of the valve and, in the case of valves of the double bellows type, which will be referred to later, by using a material of low heat conductivity between the thermal bellows and the gland bellows.

(c) *Adsorption Charge* (fig. 39, curves D & E).

In this type the thermal system is charged with a solid adsorbent substance such as activated carbon and an inert gas. Pressure changes with temperature occur through the process of adsorption in which one substance, the adsorbent (activated carbon) takes up another substance, the adsorbate (the inert gas) and the amount of the gas adsorbed increases as the temperature falls. Thus the amount of "free" gas in the thermal system is reduced at low temperatures and a lower pressure results.

A characteristic of the adsorption charge used on certain valves is that when a given temperature is reached a further temperature rise gives a reduced rate of pressure increase and this in turn results in a rapid increase of closed superheat above a certain evaporator temperature.

This widening of superheat tends to reduce the load on the motor during pull down because the valve will not begin to work until the evaporator temperature or pressure has dropped to a value corresponding to the superheat below the phial temperature.

A further advantage of this valve is that along with this motor overload protection, reversal of charge is impossible. Valves working on the adsorption principle are relatively slow in their response to temperature changes but this damping action is not necessarily a disadvantage.

Charge Characteristics

(a) *Straight Charge* (fig. 39, curve A).

In this case the thermal system is charged with the same refrigerant as that used in the plant. All straight charges have a small closed superheat at high temperatures and a wide superheat at low temperatures. This can be explained if the balance diagram (fig. 38) is consulted where it will be seen that the excess temperature required to bring the valve to the point of opening is equivalent to the spring pressure. Now this spring pressure remains constant at whatever temperature the valve is operating. At high temperature the number of degrees required to give this extra pressure is much smaller than at low temperature.

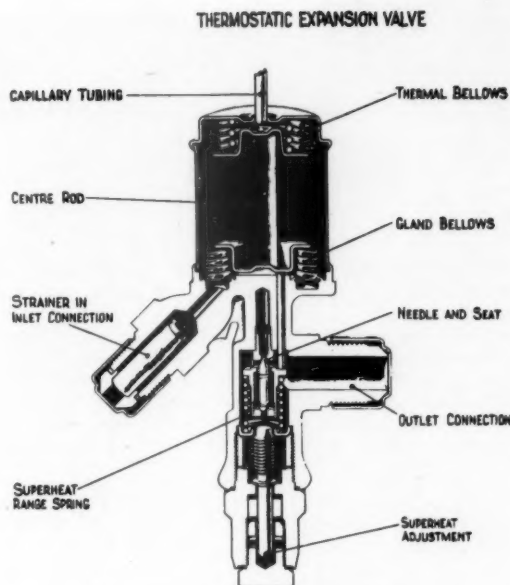
(b) *Cross Charge* (fig. 39, curve B).

In this type the thermal system is charged with a refrigerant which is not the same as that used in the plant. The reason for this change is that certain desirable characteristics can be obtained by this method. Depending on the charge, two distinct results are obtained. These are :—

- (i) Refrigerant-12 valves with a methyl chloride charge. The result is a practically constant superheat over the whole range of evaporating temperatures from $+50^{\circ}$ to -40° F. This is a very good charge which reduces the necessity for adjustment of superheat when operating at lower temperatures.
- (ii) Methyl chloride valves with sulphur dioxide charge. Refrigerant-22 valves with Refrigerant-12 charge. The result is that the superheat narrows rapidly as the evaporator pressure drops. This is a rather dangerous charge to use for low temperatures as the valve, unless reset, will reach a condition where it will not close. One advantage of this type of valve is the wide superheat at high temperatures which will, when a liquid charged valve is used, give some motor overload protection and yet remain protected against reversal.

The Double Bellows Valve (fig. 40).

This valve was developed in an attempt to get a fairly constant superheat over a limited range of evaporating temperatures. The valve itself consists of a normal thermostatic expansion valve body in which the single bellows has been replaced by a gland bellows and a thermal bellows. The motion of the thermal bellows is transmitted to the valve needle through a push rod and the gland bellows.



by courtesy of Teddington Refrigeration Controls Ltd.

Fig. 40.—Double bellows type valve.

The principle of operation is based upon the fact that the gland bellows is of slightly greater effective area than the thermal bellows so that an out-of-balance force always exists between the thermal and gland bellows due to the difference in areas. At high temperatures this out-of-balance force is greatest due to the slope of the vapour pressure curves and so the upward thrust gets a greater boost than at lower temperatures. This tends to make the superheat change less over a given range.

(to be concluded next month)

H.P. Full Flow Valve

The H.P. full-flow valve made by **Hydraulics & Pneumatics Ltd.**, is for use in pipelines to control the flow of liquids and gases. It is intended for the oil, marine, gas, chemical and fruit drink industries; for breweries, distilleries, dairies and laundries; and for food—such as ice-cream—which may be passed through pipes. In the small sizes it may be applied to general instrumentation. The valve has flanged or socket ends for incorpora-

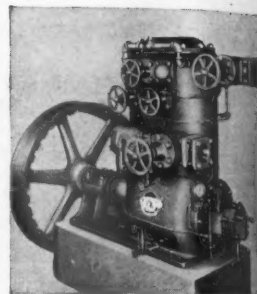
tion in the pipeline; and varies in diameter from $\frac{3}{8}$ to 4 in. Pressures may vary between 140 p.s.i. and 5,000 p.s.i. The shut-off unit is a spherical metal ball with a hole bored through it. In the open position this hole registers with the bore of the pipeline, and the liquid or gas flows without turbulence, as in a smooth pipe. Turn the ball and the valve closes. The ball is mounted in two annular discs of composition, concentric with the pipeline, which form a seal in both

directions when the valve is closed. The spindle which turns the ball passes through a seal above the ball and fits a cruciform slot in it. Stops limit the turn of this spindle to full on one way and shut at 90° . By resetting the spindle in the cruciform slot, the valve may be adjusted for clockwise or anti-clockwise closing. Maintenance of the valve is simple and the life is long, because only seals are liable to wear, and they can be replaced. Spares are reduced to a minimum.



COMMERCIAL AND INDUSTRIAL SECTION

Manufacturers' and distributors' news



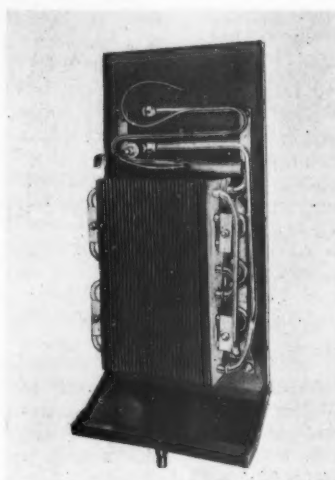
On Thursday October 30, the 50th anniversary in business of **Mr. W. A. Bennett**, chairman and managing director of **Associated Fisheries Ltd.**, was suitably marked. Mr. W. A. Bennett has 48 directorships. He is chairman and joint managing director of the **London Ice & Cold Storage Co. Ltd.**, which he founded in 1920, and holds the same appointment with the **Grimsby Cold Storage Co. Ltd.**, which provides low temperature storage facilities for over 16,000 tons of goods.

It is understood that **Pulsometer Engineering Co. Ltd.** are negotiating for the acquisition of the capital of **B.A.L. Ltd.** and of **J. Caslake Ltd.**, manufacturers of specialized equipment for the oil industry. The deal will involve something around £856,000. This will be satisfied by the issue of £700,000 of debenture stock and about 165,000 ordinary 5s. shares. Turnover of the **Pulsometer Group** has been maintained but the profits for the first six months of the current year show some decline. However, the directors anticipate that the position will improve in the second half of the year.

In accordance with the policy of **Jacobson Van Den Berg & Co. (U.K.) Ltd.** to provide the best possible service to their customers, they have now been appointed the sales agents of **Viking Engineering Co. Ltd.**, of Manchester, manufacturers of horizontal splitting and profiling machines and vertical cutting machines for polyurethane foams. **J.V.D.B.** are now able to offer the following chemicals and equipment for the production of polyurethane foam: **Wyandotte Chemicals Corporation**, **Pluronic polyethers**, **Tetronic polyethers**, **Polypropylene glycol 2000**, **Polyethylene glycol**. **Pittsburgh Plate**

Glass Co., Dimer based selectrofoam resins. **Gabriel Williams & Co. Inc.**, Polyurethane foam machine for slab or mould production. **Viking Engineering Company**, Horizontal splitting and profiling and vertical cutting machines. The viking machine comprises essentially a heavy, strong, fabricated machine plate framework. The slide blocks are of cast-iron and these move in accurately machined slots. These blocks carry either the rolls for profiling or the conveyor and control roller while splitting.

Refrigerator Components Ltd. of 1 and 2 Greycoat Place, London, S.W.1, announce a line of new,



wall-mounted, convection type evaporators. These compact coolers, designed on the basis of only three fins per inch, take up a minimum of cabinet space. They have been designed to be competitive in price without loss of quality. A thermostatic

expansion valve is included as standard equipment, a special feature being made of easy accessibility of controls, etc. Installation is, therefore, very straightforward as there are only two outside connexions to be made. As regards the heat exchange, the liquid line feed, reversed to suction line return, not only assists the drying of the coil but ensures that the coldest liquid enters the expansion valve. Made of 20 g. mild steel, and rust-primed, the whole unit is attractively finished in hammer blue hard enamel.

The **Visco Engineering Co. Ltd.** announce they have appointed the **Swansea Sheet Metal Engineers Ltd.**, **Albion Works, Morriston, Swansea**, as their agents for South and Central Wales together with the counties of **Monmouthshire** and **Gloucestershire**.

Polyzote, expanded polystyrene, is a unique plastics material which has many uses. To introduce potential users to a few applications, **Expanded Plastics Ltd.** have produced a new booklet on it. **Polyzote** has many important advantages in the packaging industry. It can be moulded exactly to the contours of the product it encloses. It can be used for moulding display shapes and figures. As it is available in tinted shades, it has an attractive finish. **Polyzote** is buoyant and can be used for floats, life-buoys and swimming aids. Its low thermal conductivity make it an ideal insulant. Since its electrical characteristics are excellent, it has many advantages for electronic apparatus where extreme lightness is required. All these differing applications are described and illustrated in the booklet.

"WIDER STILL AND WIDER-



SHALL THY BOUNDS BE SET"

In 1956 we installed the refrigerating plant for the Birds Eye frozen food store at Great Yarmouth—a single room of 250,000 cubic feet and at that time one of the largest single span storage rooms in Europe. We have just completed the installation of Birds Eye's newest store at Lowestoft—also single span, also low temperature, *BUT MORE THAN TWICE THE SIZE OF THE GREAT YARMOUTH STORE*. Over 14 miles of steel tubing, wound into grids, line the

walls and ceiling of the cold chamber and some idea of the immensity of this room can be gained from the fact that 140 London buses could be parked comfortably inside it. These are only two—even if the two largest—of more than 60 cold rooms which we have been privileged to equip for Birds Eye during the past eight years and we are proud of the knowledge that the major part of our business is made up of such repeat orders from world leaders in many industries.

People who really know and who make sure that each job is the utmost value for money come to Lightfoot-again and again

LIGHTFOOT
REFRIGERATION

ABBEYDALE ROAD, NORTH CIRCULAR ROAD, WEMBLEY, MIDDLESEX

FWS

George Kent Ltd. announce the recent appointment to the board of their Belgian subsidiary company, Kent-Continental S.A., of Mr. F. J. Havenith as local resident director. Mr. Havenith has been the manager, first of Kent's Brussels office and subsequently of the Belgian Company, since its formation. In addition to his work in the Belgian market, Mr. Havenith has direct supervision of Kent offices and activities in Germany and Holland and is working in close contact with the agents in Switzerland, Messrs. Socsil of Lausanne. Kent-Continental S.A. also act as a central spares and service organization for many Western European countries—although in most cases local stocks of spares and service are maintained, in addition, in each country concerned.

The accompanying photograph shows a 12-station model—Jackstone



Froster machine at the Hull International Shipping & Commercial Fishing Exhibition—whereat many enquiries were received, state Ross

Group. The first order came on the morning of the opening day. On the walls two factory view enlargements were displayed and "Junior" and "Senior" machines were featured, along with various packs in trays.

* * *

Sigmund Pumps Ltd. have appointed Mr. H. P. Lord, A.F.C., B.Sc., the present general sales manager, to the board of the firm.

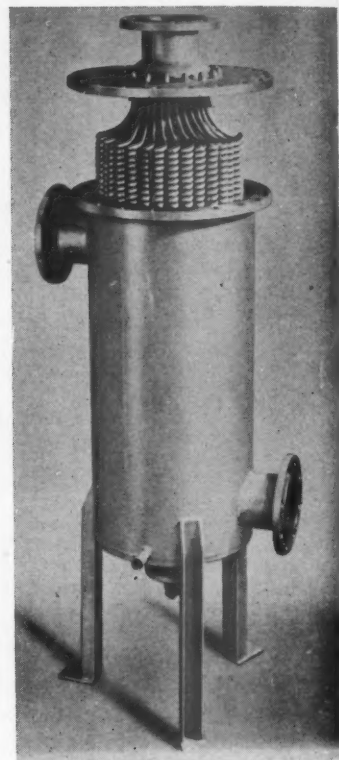
* * *

A new type of protective suit made with Geon PVC sheeting has recently been introduced jointly by **Spemby Ltd.**, Manor Road, Chatham, Kent and **Plysu Products Ltd.**, Woburn Sands, Bletchley, Bucks. Designed and developed primarily to fulfil the requirements of the United Kingdom Atomic Energy Authority this suit affords the wearer complete protection against radio-active dust while allowing maximum freedom of movement. The Spemby suit is invaluable for the inspection of petroleum tanks and gas holders, refrigeration plant emergencies, in the oil, chemical, cement and other industries—in short, wherever there is atmospheric contamination by toxic fumes, gases or dust particles. Special features of the suit include full ventilation to the body extremities, and helmet air supply, both controlled by the wearer; reduced fatigue since the weight of the air hose is taken by a special harness; unrestricted vision in all directions.

* * *

Mr. A. H. Napper, export director of **Industrial Asphalts Co. Ltd.**, left London by air last month for a three-months round-the-world tour, concentrating on the Far East and America. He is visiting agents and customers in 10 of the 60 countries to which the company exports. On his way back to Britain, he will also visit America for an exchange of views with the parent company, the **Flintkote Company**, of New York. **Industrial Asphalts Co. Ltd.**, established in Britain in 1931, manufactures a wide range of industrial materials, including bitumen emulsions, rubber and resin products and bituminous compounds for the building, civil engineering, automotive, marine, railway and insulation industries.

On a recent visit to Stroud, our representative was able to inspect an example of the helitube heat exchanger made by **British Boiler Accessories Ltd.** The B.B.A. heat



exchanger consists of narrow tubes tightly coiled into a helical shape and housed in an external jacket. High quality seamless tubes are secured to the tube plates by means of a tight fitting ferrule, which beds the tube into a grooved seal. This method of fixing applies to copper, aluminium and copper alloy tubes. In the case of steel tubes they are all welded into the end plates. Both methods of fixing tube ends ensure a dead tight seal and allow for no movement of the tube ends throughout the life of the tubes. The tube plates are rigidly fixed in the tube jacket without the necessity for expansion plates or a floating head, no stresses are put on the tube end fixings because of the light springy action of the tubes which withstand

vibration and high variations in temperature.

A modern showroom has been opened at 52-62 Pitt Street, Edinburgh, by John Clephane & Sons Ltd. to handle a full range of domestic appliances. Special attention is being given to washing machines, refrigerators and central heating. The new showroom is attractively laid out and is one of the finest to be opened recently in the city.

Congratulations to Imperial Chemical Industries Ltd. on their fine production of a brochure describing "Arcton" refrigerants. The front and back of this publication is concerned with the technical data expected of such a work (it actually goes beyond one's expectations, for the Mollier charts reproduced fold out to a really worthwhile size for accurate figuring) while the body of this colourful, stiff-covered brochure contains a pictorial record, with short text, of the multifarious applications of refrigeration in trade and industry. Here is a work that deserves wide dissemination.

Mr. R. C. Agabeg has been appointed assistant sales manager of the chemicals division of Union Carbide Limited with effect from October 6. Mr. Agabeg, a graduate of London University, was formerly employed with the sales development group of Monsanto Chemicals Ltd. and more recently as assistant development manager of the plastics division.

As the modern world becomes more noisy, so does the need for effective and scientific sound absorption become an important factor to combat nervous and mental fatigues especially in industrial and public buildings. As fuel costs continue to rise so does the need to pay an increasing amount of attention to the elimination of excessive heat losses especially through ceilings and roof spaces. Speaking at the Hurseal Heating Centre last month to introduce the "Dampa" ceiling to architects, heating engineers and the Press, Mr. J. Fischer of Copenhagen stressed the considerable use being made of acoustic insulated ceilings on the Continent. Mr. J. Fischer, B.Sc., M.INST.C.E. (Copen-

hagen), is the originator of the "Dampa" ceiling and chief engineer of his company Det Fyenske Trælast-kompagni, one of the largest manufacturers of acoustic ceilings in the world. Extreme adaptability is claimed for the ceiling. Basically it consists of finely perforated, stove-enamelled, narrow, aluminium strips with an inlay of specially processed mineral wool, combining a high capacity for sound absorption and insulation with light weight. The special aluminium alloy for the strips and panels will be produced in this country by The British Aluminium Co. Ltd. Hurseal are also co-operating closely with J. Avery & Co. Ltd. of 81 Great Portland Street, London, W.1., manufacturers of aluminium venetian blinds, in the production, marketing and erection of the ceiling. A separate organization for this purpose is already in the course of establishment by Hurseal and Avery.

Mr. H. E. Cooper has been appointed managing director of G. A. Harvey & Co. (London) Ltd. Mr. Cooper, first appointed to the board in 1946, has been acting as deputy managing director since May of this year. Mr. I. A. Marriott succeeds Mr. P. T. Bliss as sales director. Mr. Bliss, who has been with the company for 50 years retires on December 31.

The cold "Bonderite" system for spray pretreatment plants is now firmly established in the United States of America where extensive production line experience has shown that steam costs can be reduced by up to 70 per cent., water consumption cut by 20 per cent. whilst maintenance time and labour costs are also appreciably lowered. This system has now been made available in the United Kingdom by The Pyrene Company Ltd. and the results already obtained here show savings in every way comparable with those obtained in America. Indeed, production experience in this country has already shown that the coating results obtained are equal to those of conventional cleaner and phosphating materials at greatly reduced overall cost. The cold "Bonderite" system is designed

primarily for treating steel by spray application, but mixed production of steel and most types of zinc surfaces may also be coated in the same solution. However, if production consists entirely of zinc, other "Bonderite" systems are preferable. The cold "Bonderite" system has effected remarkable fuel economies whilst loss of water by evaporation has also been significantly reduced. In addition maintenance has been drastically curtailed, particularly coil cleaning, the need for which has been almost eliminated. In the case of plant stoppages, the shut-down period prior to entering the spray tunnel has been almost obviated since there is no longer any need to wait for the plant to cool. The system includes new cold alkali cleaners effective within the temperature range 60-120° F. and a new cold "Spra-Bonderite" process. In many cases, rinses can be run cold. In using the new cold "Bonderite" system the chemical costs are no higher than with conventional processes and in fact in many cases the chemical costs are reduced. The treatment converts the metallic surface into a non-metallic zinc phosphate coating which inhibits corrosion and increases the adhesion and durability of paint finishes. This substantial increase in the life of the paint finish results from the fact that the coating provides a clean, grease-free surface which is a corrosion inhibiting base for paint, and also acts as a non-conducting bond between the paint and the base metal.

An important side of Foxboro-Yoxall's comprehensive industrial control instrument service is the training school now installed at the new Redhill factory. The school was started in 1951 to meet the growing demand for training by Foxboro-Yoxall's customers. Something more than sporadic instruction in one or other of the company's factories was needed and so a fully-equipped and staffed training school was set up at Wandsworth. Only limited accommodation was then available but more than 700 people received training between 1951 and 1958 with some 10 per cent. coming from overseas. At first instruction was confined to two-week maintenance courses. Later advanced

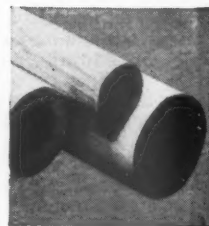


And now...
**Rocksil Rigid
pipe-sections**

Resilient
ROCKSIL
ROCK WOOL INSULATION

That's the latest addition to this highly successful range of rock wool insulating materials. Great strength, accuracy of manufacture, and superior finish, along with all the usual properties of Rocksil, make these rigid sections an efficient means of insulation up to 600°F. For hot water lines, steam lines, and steam traced oil lines, Rocksil rigid pipe sections provide well-fitting and inexpensive insulation that is particularly resistant to corrosion.

Canvas or scrim wrapped, with or without bands
In 3 ft. lengths, thicknesses by $\frac{1}{2}$ " steps from $\frac{1}{4}$ " to 2". Uniform density 10 lb/cu. ft.



Full information available from the manufacturers :

THE CAPE ASBESTOS CO LTD 114 & 116 Park Street, London W.1. Telephone: GROsvenor 6022

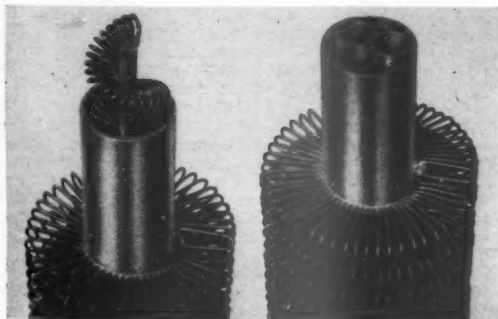
and at: Glasgow: Eagle Buildings, 217 Bathwell St., Glasgow, G.2. Tel: Central 2175
Birmingham: 11 Waterloo St., Birmingham 2. Tel: Midland 6565-6-7

Manchester: Floor D, National Buildings, St. Mary's Parsonage, Manchester 2. Tel: Domesgate 6016-7-8
Newcastle: 19 & 20 Exchange Buildings, Newcastle-upon-Tyne. Tel: Newcastle 20488

courses were also provided. Now, at Redhill, the School is installed in spacious premises specially designed for the study of instruments in the light of the experience gained over the past eight years at Wandsworth. Each student has a bench equipped with compressed air and electrical supplies. Full ranges of Foxboro-Yoxall instruments, control valves and auxiliary equipment are provided for the student to dismantle, reassemble, calibrate and adjust under typical conditions. Adjoining this workshop area are offices for the instructional staff and a modern lecture room.

* * *

In every field of industry throughout the years the satisfactory transfer and dissipation of heat has been a problem of the first magnitude. Many types of heat transfer tube have been designed to meet the various requirements, the most efficient tube with extended surface yet designed may be the "Clayton-Still" spiral wire wound tube, a unique tube which has been manufactured and marketed solely by Clayton Dewandre Company since its introduction. The "Clayton-Still" heat transfer tube is unique by reason of its dissipating surface, which, in contrast to the more usual finning or gilling takes the form of a spiral wire winding. The large dissipating surface—which is clearly illustrated—aided by air turbulence induced by the formation of the wire, gives a very high coefficient of heat transfer, which, by comparison with other heat transfer tubes, results in less tubing being required for any given application.



Tubes with the surface extended within the bore.



The refurbished premises of Refrigeration (Borough) Ltd., Borough High Street, near London Bridge, photographed by "M.R." recently.

Alfred Herbert Ltd. have been appointed sole distributors in the British Isles for measuring and inspection equipment made by Censor of Liechtenstein. This equipment is made in two types: high-speed, high-precision ball, roller and needle sorting and grading machines for the bearing industry.

Mr. Frank Fields, Ranco Ltd., has left on another extensive trip—this time to South Africa.

We are extremely sorry to announce that the 1959 Refrigeration Diary is sold out.

ICE BLOCK MANUFACTURE

ILLUSTRATED in these columns last month was the patented modern block ice plant being made by J. & E. Hall Limited from the Wilbushewich design.

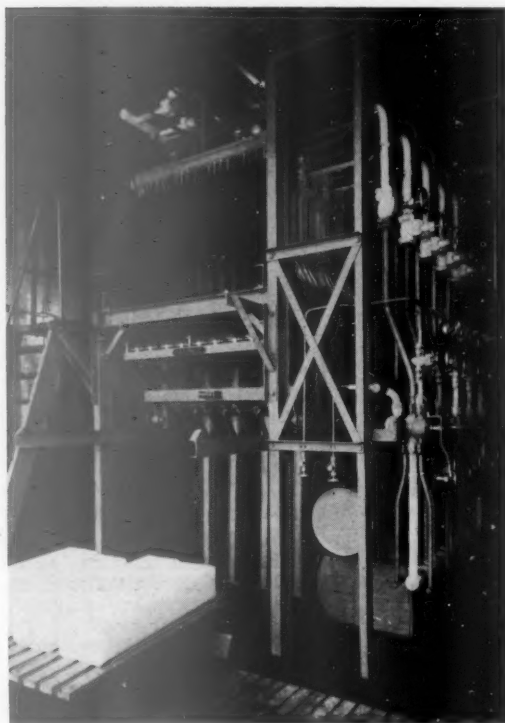
It is an unusual feature of these times that in spite of the wide use made of mechanical refrigeration for cold storage, deep freezing, air-conditioning and numerous purposes for which it is used there is still a large and expanding demand in the world for ice.

There are many forms of ice of which the block form is one. Blocks of ice are convenient to handle, slow to thaw and can be used in large or small broken pieces.

One of the biggest demands for block ice is for packing with perishable foods such as fish and a considerable amount is used for cooling transport vehicles and for chemical process work.

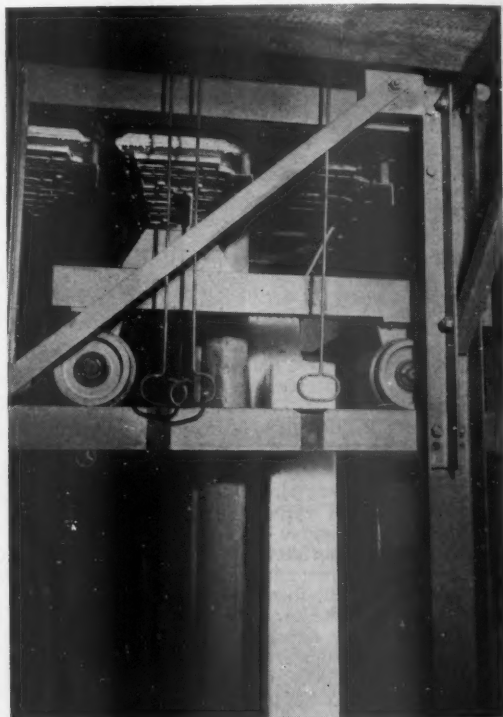
The plant which Hall's demonstrated has certain features which make it particularly interesting :—

There is no secondary refrigerant used, such as brine, which involves large tanks and takes up much space. Economy in space, therefore, is a very important advantage ; the plant can conveniently be powered



by a single diesel engine and therefore can be used in places where there is no electricity supply ; since no power is required for electrically driven brine propellers and ice cranes it is an economical plant in power consumption ; the plant can be placed in the open and does not necessitate a roof although it is, of course, better to have one ; the plant can be turned on and off conveniently at any time and since the

freezing time of a block of ice is about 2 hours the plant can be used economically for only a few hours a day for reduced outputs. This cannot be done with a brine tank type of ice plant ; there is an absence of mess and corrosion from which so many brine plants suffer due to the mixing of calcium chloride brine and to splash of brine from the tanks ; a " Rapid Ice " plant is far more durable and being readily accessible is more easily maintained than a plant with brine tanks ; a " Rapid Ice " plant can also be moved from sites.



The blocks being discharged from the bottom of the moulds.

The moulds which are open at the top and closed at the bottom by hinged aluminium flaps, are arranged on a self-supporting structure. The hinged flaps have no sealing joints, but are made watertight by freezing them to the bottom of the moulds before each mould is filled with a controlled quantity of pre-cooled water by the operation of a single valve. When the blocks of ice are ready for harvesting, hot gas from the compressor is circulated through the system, the changeover from freezing to thawing being effected by the operation of a second valve, the spindle of which is turned through an angle of approximately 90°. The blocks of ice then drop through the flaps on to a harvester, which is positioned below the row of moulds to be thawed, and are automatically lowered to the ground. The control of the plant is, therefore, very simple and can be left with safety in the hands of unskilled operators.

Freezing time for standard blocks is :—

| | | |
|--------------------|--------------------|--------------------|
| 100-112 lb. blocks | 200-224 lb. blocks | 300-336 lb. blocks |
| 1½ hours | 2 hours | 3 hours |



CARDIFF Cardiff 26408



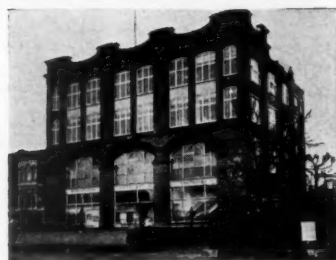
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L. STERNE & CO. LTD.

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The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENTral 4694)

DECEMBER MEETING

AT the meeting of the Institute to be held on Thursday, December 4, 1958, at 5.30 p.m. at the Institute of Marine Engineers, The Memorial Building, 76, Mark Lane, London, E.C.3, there will be a review of the meetings of commissions III, IV and V of the International Institute of Refrigeration, which were held in Moscow from September 1 to 9, 1958.

Mr. G. L. H. Bird, B.Sc., member, will speak about the meetings of commission III, and Dr. J. C. Fidler, O.B.E., B.Sc., member, and Colonel H. Randal Steward, T.D., B.Sc., member, will deal with the meetings of commissions IV and V respectively. Mr. W. B. Gosney, B.Sc., member, will give a description of the technical visits which took place in between the meetings.

THE INSTITUTION OF PRODUCTION ENGINEERS

The 1958 Sir Alfred Herbert paper of the Institution of Production Engineers on "The European Common Market—Its Origins and Implications" will be presented by Sir Cecil Weir, K.C.M.G., K.B.E., M.C., D.L., at the Royal Institution, Albemarle Street, London, W.1, on Thursday, December 11, 1958, at 6.30 p.m. (tea will be served from 5.30 p.m.).

The meeting will be open to both members and non-members of the institution, but admission will be by ticket only, application for which should be made, as soon as possible, to the secretary, Institution of Production Engineers, 10, Chesterfield Street, London, W.1.

THE INSTITUTE LIBRARY

Lending Section (continued)

Electric Resistance Heating—British Electrical Development Association.
Engineering and Industrial Instruments—Negretti and Zambra.
English Derating Appeals by Rowe and Stanton—1930.
Faraday Centenary Exhibition Souvenir Catalogue—1931.
Hearings before the U.S. Senate on Foods Held in Cold Storage—1911.

Higher Industrial Production with Electricity—British Electrical Development Association.

Hire Purchase Trading by Bolling.

History of J. and E. Hall Ltd., by Hesketh.

History of L. Sterne & Co. Ltd., by Sir Samuel R. Beale, K.B.E.—1951.

History of the Port of London by Sir Joseph G. Broodbank—1921.

International Association for Testing Materials—London Congress, 1937.

Lighting in Industry—British Electrical Development Association.

Liverpool Engineering Society—Volume 55—1934.

Materials Handling in Industry—British Electrical Development Association.

Modern Public Cleansing Practice by Thomson.

Patents for Inventions by R. Haddan—1937.

Port of London Ready Reckoner for Dock Charges.

Proceedings of the General Discussion on Heat Transfer—1951—Institution of Mechanical Engineers.

Proceedings of the Joint Conference on Fatigue of Metals—1956—Institution of Mechanical Engineers.

Report of Refrigeration Research Committee of Institution of Mechanical Engineers—1914.

Sheep Farm and Station Management—Pearse.

Three Hundred Years on London River (The Hay's Wharf Story) by Ellis—1952.

Trade Marks by Haddan—1938.

U.S. Department of Agriculture Report—Volume I—1903.

(Concluded)

Dame Caroline Haslett Memorial.—A memorial fund has been established in recognition of the great contribution made by the late Dame Caroline Haslett to many aspects of modern living, and to ensure that causes to which she devoted herself would be maintained. Dame Caroline's earliest interest was in engineering; then in engineering applied to the home; and then, through the domestic

REFRIGERATION

BY WILLIAMS



Part of the low temperature refrigeration plant installed for Messrs. Eskimo Foods Limited, Cleethorpes, Lincolnshire

G. Williams Engineering Company Limited were responsible for the design and installation of the complete plant which has a total capacity of 1,200,000 B.Th.U.'s per hour at -35°F .

Six Williams Contact Plate Freezers are shown and space is reserved for a further two units.

For quick freezing and storage plants consult Williams.

G. WILLIAMS ENGINEERING CO LTD

Disraeli Road Willesden London NW10 Telephone ELGar 4225

We design and manufacture to your requirements

uses of electricity and the consequent saving of labour, in the contribution women could make to local and national affairs as housewives and as business and professional women. The memorial fund is in two sections. The first section will provide educational opportunities for women employed, or seeking to be employed, in the electrical industry not only on the domestic science

side but also in engineering. This section will continue and extend the work of the present Caroline Haslett Trust which was launched in 1945 with the approval of Dame Caroline herself. The second section will provide educational opportunities in this country or abroad for women in scientific, engineering, technological or technical fields apart from the electrical industry.

STUDIES ON BEEF QUALITY

The Commonwealth Scientific and Industrial Research Organization of Australia have this year published a report on studies of the influence of certain holding conditions on Weight Losses and Eating Quality of Fresh and Frozen Beef Carcasses. The report will also be published by D.S.I.R. as Special Report No. 67.

The following is a review of the studies from a commercial and economic angle.

All meat purchased from the slaughter floor of an adjacent abattoir—presumably on the day of killing but not necessarily so.

All meat placed in chiller at 31° to 35° F. for 24 hours.

| Post chilling treatment | Mean % weight loss during post chilling treatment | | Mean % subsequent loss after freezing and holding 18 weeks at 14° F. | | Loss to meat producer | | Drip % weight loss on thawing as quarters for 48 hours at 50° F. | | Drip % weight loss on holding as butcher's cuts for a further 24 hours at 50° F. | | Loss to butcher | |
|---|---|-------------------------|--|-------------------------|-----------------------|-------------------------|--|-------------------------|--|-------------------------|-----------------|-------------------------|
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) | (m) |
| | Grade I | Manu- factur- ing | Grade I | Manu- factur- ing | Grade I | Manu- factur- ing | Grade I | Manu- factur- ing | Grade I | Manu- factur- ing | Grade I | Manu- factur- ing |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| I 1 day at 32° F. plus 2 days at 68° F. | 1.625 | 3.875 | 0.906 | 2.3 | 2.531 | 6.075 | 0.47 | 0.66 | 1.52 | 1.6 | 1.99 | 2.26 |
| II 3 days at 32° F. | 0.687 | 0.75 | 1.125 | 3.94 | 1.812 | 4.69 | Nil | 0.55 | 1.28 | 1.73 | 1.28 | 2.28 |
| III 14 days at 32° F. | 1.5 | 2.94 | 1.5 | 2.625 | 3.0 | 5.565 | 0.22 | 1.11 | 1.51 | 1.46 | 1.73 | 2.57 |
| IV To freezer direct | — | — | 1.187 | 2.578 | 1.187 | 2.578 | 0.46 | 1.64 | 1.51 | 1.66 | 1.97 | 3.3 |

It will be noticed from Column (e) Manufacturing Meat lost more weight in holding three days at 32° F. than in holding 14 days at 32° F., which does not ring true. The figures in Columns (h), (i), (j), (k) refer to the test piece showing the maximum loss out of three test pieces.

The full Report shows wide variations in the losses of each set of three test pieces treated in the same manner.

To quote from the Report : "There is some evidence that the combined loss is greater from fores than hinds."

It would seem from the above figures that it is to the advantage of the meat producer to omit any post chilling treatment and to pass the meat to freezer direct (IV). On the other hand, meat subjected to a post chilling treatment of holding three days at 32° F. should show least loss by drip to the butcher (II). Comparing the total loss of weight by the two methods we get :—

| Treatment IV | | | Treatment II | | |
|------------------|-----|---------------|------------------|-----|---------------|
| Loss to Producer | ... | 1.187% | Loss to Producer | ... | 1.812% |
| Loss to Butcher | ... | 1.97% | Loss to Butcher | ... | 1.28% |
| | | <u>3.157%</u> | | | <u>3.092%</u> |

Treatment II could thus save 0.065 % of weight loss, which at a retail price of Grade I beef at 4s. 6d. per lb. has a monetary value of 0.035 pence per lb.

Treatment II would, however, necessitate three additional days holding at 32° F. which at the rate of 15s. per ton per week is equivalent to 0.034 pence per lb. so that any economic advantage of Treatment II is negligible. Moreover, the report, referring to subsequent organoleptic tests, to determine tenderness, overall acceptability, etc., of the resulting joints states : "Freezing tends to reduce or eliminate these trends by shifting all scores to a level which approximates the fully tenderized fresh meat."

G. A. MAY.

NOVEMBER 1958



blocks; courtesy *Frigidaire News*

MODERN MERCHANDISING

THE REFRIGERATED CABINET IS THE BASIS OF TO-DAY'S SELF-SERVICE FOOD STORE

“**F**OOD retailing methods have undergone many changes throughout the years, particularly since the last war, but it is doubtful whether any of these have been quite so drastic or concentrated as the change that has been effected by the introduction and growth of self-service marketing,” states the editor of *Frigidaire News* in a delightful, full-colour supplement last month on self-service installations.

“A few years ago we were engaged in pioneering what was then little more than a principle; to-day self-service is established with both public and progressive trader alike as a hygienic, speedy and profitable retailing reality.

“In fact, to-day the number of self-service stores in this country is approaching 5,000 with new openings and conversions taking place at the rate of 700 to 1,000 a year. Supermarkets and superettes are springing up almost overnight and progressive independent grocers throughout the country, suddenly aware of the need for competition, are busily converting their shops.”

The colour illustration, reproduced above from the supplement in *Frigidaire News*, shows a general view of the Waitrose Self-Service Store at Staines, Middlesex, for which three cold rooms and a total run of 114 ft. of refrigerated display have been supplied and installed by R. E. A. Bott (Wigmore St.) Ltd.

On The Retail Shop Front

Where Changes are Most Evident

By Our Special Retail Correspondent

IT is extremely important for the makers and distributors of refrigerated cabinets for retail use to keep their ears close to the ground. The continuing development of this section of the industry on a sound basis may depend upon their ability to hear the sound of approaching changes that are not always apparent to the eye. There will always be a certain amount of haphazard, catch-as-catch-can selling of refrigerated equipment; but that is not the kind of selling that makes for stability.

More carefully planned selling to retailers, based on foreknowledge of the coming changes in methods of food merchandising and on foresight of the likely effect of those changes must be the principle of operation. And the refrigeration industry should be prepared to sponsor whichever of those changes which seem to show most signs of meeting the requirements of the housewife of to-morrow.

Since October of last year I have been recording

many of the changes that have been brought about. Within the 12 months that have passed since then, the tempo of change has been more rapid. There has been wider acceptance of the principles of self-service by housewives. Supermarkets have grown in number. Butchers have increased their refrigerated display; so have fishmongers, and far more of the latter now have quick-frozen food cabinets. Fruit shops with q.f.f. cabinets are on the increase. But few of them use refrigeration for fresh produce: progress in this last respect has been negligible. Even where prepackaging of fruit and vegetables is applied on a fairly large scale there is seldom an accompanying use of refrigeration.

With the prepackaging of wet fish, on the other hand, refrigeration is essential. Conspicuously marking an important stage in the marketing of this class of merchandise is the conversion of one of the Mac Fisheries branches at Surbiton to the sale of prepackaged wet fish. The conditions



Fig. 1.—Mr. Jelley's shop at West Ewell before the change.

Fig. 2.—Taken from the same spot after the change.



here for testing consumer response or rejection are ideal, for not only is the shop superbly equipped, but, not far away on the other side of the road is another equally modern branch of Mac Fisheries displaying unwrapped fish to which women who disapprove of prepacks can easily transfer their custom.

Apart from the assistance it provides for an important and interesting experiment, the refrigeration of this prepack shop is worthy of mention in its own right.

The large multiple companies are obviously better placed to pioneer in this way. But, while serving their own ends, Mac Fisheries are performing an invaluable service for the fish industry in trying to discover what really is the housewife's choice on fish-selling methods.

Among the individual retailers it is the fish-mongers and fruiterers who are most effectively demonstrating their sturdy independence. Of grocer's shops at present it is not possible to report so favourably. Several thousand individual grocers are in a state of unsettlement and are too preoccupied with supermarket-raid-precautions to consider investment in new equipment for refrigerated display. At the moment of writing a number of them are again in a huddle with Garfield Weston: this time at Harrogate. But there are, as I said in July, still some grocers left who do not feel in need of salvation by big-group operation. As for the fruiterers, their

policy, by and large, is not to worry. Virtually ignoring prepackaging, seldom, if ever, affected by the rise of the supermarkets, the only concession many of them make to mid-twentieth century progress is to install a quick-frozen food cabinet, the pristine whiteness of which stands out in vivid contrast to the dowdy bins by which it is flanked. There are, on the other hand, instances of q.f.f. cabinets, like television sets in domestic quarters, being more often the cause than the effect of internal refurbishing. Shopfitting and refrigeration can, and do at times, work in partnership to the benefit of both.

For various reasons the fish-and-chip business is generally in a less flourishing state than it once was. How far the steadily increasing popularity of quick-frozen fish fillets (not to mention fingers and sticks) have broken the allegiance of the one-time faithful clientele, it is difficult to say. Refrigerated displays of prepackaged wet fish may still further adversely affect the fish-frying trade. But there are other factors that do not concern us here.

Mr. Jelley of West Ewell, Surrey is one member of the fish trade who sees a bigger future in the sale of fish under refrigerated conditions than in the frying business. He has recently made some drastic alterations, and his shop in several respects typifies the changes that are being brought about in fish retailing.

Up to comparatively recently, his business was in three departments: normal sales from the slab,



Fig. 3.—A close-up of the refrigerated counter at West Ewell.

Fig. 4.—A conveniently sited cabinet at Besses o' th' Barn.



Fig. 5.—A "shelf"-fronted cabinet at Didswell, Manchester.



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Cold Stores By Frigidaire: cold rooms for fish, meat, provisions, poultry, dairy produce, fruit and vegetables; pre-packed meat locker; freezer room.

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1110

MODERN REFRIGERATION November 1958

a frying range at the back of the shop, and a prominent recessed space behind the right-hand window equipped with two cabinets for the sale of quick-frozen foods.

He has now scrapped the frying range, reduced the slab area to a few feet in the window, given more space for frozen foods and had a Cooltop refrigerated counter case fitted to a counter running across the shop. This gives him adequate facilities for wet fish display, while leaving more space in the shop for the movements of both customers and staff. The refrigerated counter top was installed by Burnett's Refrigeration Services of Kingston, and it is operated by a Sternette condensing plant.

An exception to the drab bin setting for the white q.f.f. cabinet is the shop of Mr. J. D. Yates; this shop in the Besses o' th' Barn area of Whitefield, Lancs. is a model of hygiene and attraction. The Kelvinator cabinet with its front showcase is set at right angles to a counter of a grey colouring with a grained finish and the wall is faced with imitation tiled paper. He is here seen (left) talking to Mr. G. G. D. Rennie area sales manager of Birds Eye Foods, Ltd., while Mr. Yates looks on with interest.

The vast range of quick-frozen products now in distribution, combined with the need for more

refrigerated space for prepackaged products—meat, fish, fruit, vegetables, cheese, bacon—at times gives cause for wonder whether refrigeration is keeping pace with these developments. Prepackaged meat, in particular, calls for a liberal allotment of refrigerated space; generally the full width of the back of the supermarket. Yet very little, if any, use is made of double-deck cabinets for this purpose, which would release an appreciable area of floor space for other purposes.

Not all quick-frozen food cabinets are constructed to give easy access to the whole of their contents.

The cabinet shown in the final picture is in the fruit shop of Mr. E. Millington, trading as Evans and Company, at 1 Barlow Moor Road, Didsbury, Manchester. Prominently placed near the doorway, facing one counter and flanking another, it has a very active trade. One of the noteworthy features of this cabinet, supplied by British Automatic Refrigerators Ltd., is the flat ledge along the front, which, as will be seen from the illustration, can be used as a temporary base for items withdrawn for inspection or awaiting transfer to the customer's basket. This ledge is at normal counter height (3 ft.). The cabinet is 4 ft. 6 in. high to the canopy top, 2 ft. 5 in. deep and 4 ft. 6 in. wide. It accommodates approximately 300 lb. of quick-frozen products.

GRIMSBY SHOP GOES S-S



THE extent to which self-service has taken a hold and the importance of its results in terms of pure economics are very interestingly exemplified by a recent case which has occurred in Grimsby.

In the Bull Ring, an old part of the town which is, in





12 ft. display cabinet for provisions and dairy produce at Grimsby.

fact, scheduled for pulling down and rebuilding in the fairly near future, Messrs. Bates operated a small, old-fashioned grocery branch, the lease of which has only a very few years to run. Notwithstanding this fact, when the butchers next door became empty Messrs. Bates decided to acquire these premises and knock the two shops into one which, even then, gave only a total area for the two shops of approximately 32 ft. frontage by 24 ft. deep. This space they decided to convert into a modern self-service store, being quite assured of the fact that even with only a few years' lease, the capital outlay would more than be repaid by the increased takings and the lower operating costs of self-service.

It was further decided that to get the best results, the job must be done properly, with the result that they now have a most attractive premises with approximately 24 ft. of wall shelving on the side walls with 1 ft. by 6 ft. and 2 ft. by 12 ft. gondolas free-standing in the shop centre. A modern new shop front was also put in. They have 12 ft. of the latest Hussmann Cascade refrigeration for provisions and dairy produce, and 12 ft. of Hussmann mass display refrigeration for meat, all on the back wall. The whole shop is brilliantly lit with attractive lighting arrangements, installed under the advice of Messrs. Philips, with a tastefully designed décor, the main motif of which

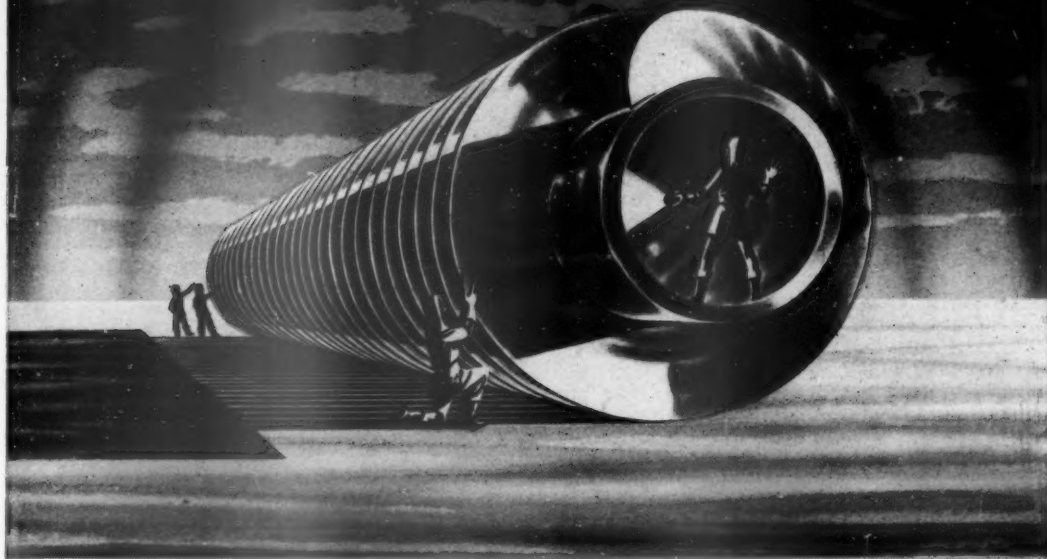
carries on from the deep red of the front of the Hussmann cabinets.

This conversion has only been completed for about a couple of months, but results to date have considerably exceeded expectations and if present trading continues, as would appear likely to be the case, the capital outlay will be more than recovered together with further reasonable trading profits long before the lease runs out. Messrs. Bates of Grimsby are to be congratulated on having such an accurate appreciation of the immediate advantages of self-service and on having the courage to put these convictions to the test.

DISPLAY CABINET WITH SPECIAL FEATURES

THE AeroPhreze "Eezi-Serve" display counter has been a big seller this summer and is meeting increasing acceptance this autumn. The actual display area is cooled by a current of air circulated by two fans. The height of the rear of the wire shelf can be varied thus allowing the most suitable angle for the display to be selected. The counter is available in two applications—both identical in exterior appearance and all details of

Well worth investigating



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finish, but one version operates at 28°/30° F., particularly suitable for prepacked meat, and the other operates at 40°/45° F., the ideal temperature for all groceries, dairy produce and cooked meats. Behind the cabinet is a large storage area—a point to remember in premises short of space. The

special drip tray (Pat. applied for) gives exceptional ease of operation. A small—but very welcome extra—is a set of special slip-in red plastic letters. These cover the names of nearly all produce likely to be placed in any cabinet.

CONVERSION IN BEDFORD

POSSIBLY one of the most interesting aspects of the ever-increasing trend towards self-service is the extent to which this revolutionary form of trading is being adopted by the older established firms with years of tradition in personal service behind them.

An interesting example of this is the recent conversion by Dudeney & Johnston Ltd. of their food department at their head branch in High Street, Bedford. Established in 1880 as a partnership and later converted into a public company, this firm quietly but firmly established itself in Bedford and the surrounding area and to-day, 78 years after they opened their first grocery, they have 26 retail branches operating in and around the Bedfordshire area, served by their three warehouses.

In addition to the usual lines of groceries, Dudeney & Johnston are also renowned for their cellars and 16 of the 26 branches are licensed. They have a great reputation for catering, both as outside caterers and in their own restaurants at their main Bedford and Peterborough branches and in addition, both these branches have large bakeries, from which freshly baked bread and cakes are sent out daily to all their other shops.

With an organization like this, Dudeney & Johnston might have been excused for feeling that the services they offered the public left nothing further to be desired, but it is consistent with the progressive outlook of their directors that with the advent of self-service, they decided that

this was a facility which they should also offer their customers. Accordingly, they have converted to self-service the whole of their existing food department, which was designed in 1929 and have further enlarged it by incorporating the space hitherto given over to a restaurant at the back of the store, with the result that the new supermarket takes up the entire ground floor of the premises and comprises 5,952 sq. ft. of selling space.

Large Straight Run

All perishable goods are displayed in a 36-ft. run of Hussmann refrigerated display case, sited along the back of the store. Of this, 24 ft. is given over to dairy produce, cooked meats, etc., whilst the remaining 12 ft. is devoted to the sale of pre-packed meats, an innovation as far as Dudeney &

(Continued on page 1118)



Double your display capacity and sales!



Photo by courtesy of Home Electric, Hounslow.

Total load on 7 brackets—1,007 lbs.

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Bulletin of the INTERNATIONAL INSTITUTE OF REFRIGERATION

By EZER GRIFFITHS, O.B.E., F.INST.P., F.R.S.,
President of the General Conference of the I.I.R.

No. 4. Vol. 38. 1958

THE various commissions of the I.I.R. have been active during recent months. Commission 1 met at Delft (Netherlands) in June; 45 papers were presented dealing with physical topics at very low temperatures.

A working party of commissions 4 and 8 met at Göteborg and Nynäshamn (Sweden) to consider biological and technical problems of the transport of bananas under controlled temperatures.

A sub-commission of commission 6, dealing with biological and medical applications of refrigeration, met in Paris.

The technical board convened in Moscow on September 1 and 2 followed by meetings of commissions 3, 4 and 5. The planning of these meetings was carried out in an admirable manner by Mr. S. Kobulashvili, president of the organizing committee and his staff, who also contributed a valuable series of communications. Commissions 2 and 7 met at Prague; here the organization was in the hands of Ing. Vladimír Ibl, director of the Research Institute for Refrigeration and Food Engineering, to whom the grateful thanks of the delegates are due for the excellent planning. An excellent series of papers was provided.

Dealing with current research in various countries, it is stated that the division of building research of the National Research Council, Ottawa, Canada proposes to study among other topics, heat flow in moist materials; water vapour permeability of membranes; thermal and mechanical properties of ice; frost action in soils; foundations for cold stores.

In Denmark, experiments are reported on the freezing of fish fillets in blocks, heat treatment prior to freezing, and the freezing of crabs and prawns.

In Sweden, problems relating to fish and vegetables are being studied. In particular storage of fish in ice treated with antibiotics and the influence of light on cold storage of potatoes.

The Refrigeration Research Foundations of the U.S.A. sponsored a large variety of projects in various centres. These include time-temperature tolerance of frozen foods, investigation of foods processed by high-temperature, short-time methods and their refrigerated storage, cold storage of dates, citrus storage.

In the University of Minnesota, U.S.A., several projects of an engineering character are in hand, such as local heat transfer coefficients around ducts with non-circular cross-sections, research on film cooling, thermal conductivities of gases, and flow and heat transfer on rotating discs. Frost heaving under refrigerated areas is to be the subject of an enquiry on an extended scale.

As regards the abstracts given in the *Bulletin* one relates to absolute temperatures in the range below 1° K. using chromic methyl-ammonium alum as the thermometric substance; another abstract relates to the supply and distribution of liquid helium. It is stated that liquid helium can be stored for weeks.

A number of abstracts refer to heat

transmission phenomena such as heat flow in horizontal liquid layers, new universal computation charts and equations concerning surface heat exchangers, for refrigeration especially. Two abstracts relate to the effect of fouling on heat transfer.

From Eastern Europe there are abstracts of papers dealing with refrigerants. One from the U.S.S.R. points out similarity in thermal and caloric properties in refrigerants and states that in order to determine the properties of the methane and ethane derivatives only a single experimental point, the normal boiling temperature, need be known.

The physiological effect of refrigerants is the topic of a paper in *Kulde*.

A paper from the U.S.A. describes work done on the development of thermo-electric refrigerators. It is stated that a temperature difference of 65° C. can be achieved. In the group of abstracts relating to equipment, a radio-active level meter is described to regulate the level of liquid ammonia in receivers of the plant. Another abstract describes a speed indicator for hermetically sealed compressors without the necessity of any mechanical connections to the compressor.

From the U.S.S.R. there is a paper relating to the thermal and physical properties of poropolystyrene; another contribution from the same country relates to methods of testing domestic refrigerators.

There is an abstract describing the causes of water freezing in capillary tubes and the clogging of strainers in domestic electric refrigerators.

Two abstracts relate to large cold stores one of 35,500 tons total storage capacity in Moscow and another to the largest cold store in the Netherlands.

A paper from the U.S.A. describes how proper refrigeration increases meat profits. It is stated that in the meat industry annual shrinkage losses due to refrigeration represents more than 100,000,000 dollars.

A mobile blast freezer is described with a freezing capacity of 12,000 lb. per day.

A series of abstracts relate to air-conditioning plants. Reference is made to British Standard Specification on the rating and testing of refrigerated air-conditioning units; to portable units; to automatic control; to efficiency rating; to air-conditioning for ships; to the heating and air-conditioning of a civilian airport.

A few abstracts refer to transport by water; one discusses the design and operation of refrigerated cargo vessels.

Heat transfer in underground chambers is dealt with in two papers from the National Bureau of Standards.

Moisture condensation and cold stored military rations is the topic of one of the abstracts.

In the section devoted to fruit, information is given as to the freezing points of fruits, vegetables and florist stocks.

Two abstracts refer to the time-tolerance of frozen foods. Under the heading "vegetables" is found abstracts relating to onion storage and the keeping quality of dried vegetables and potatoes.

A paper presented at the Congress of Meat Experts describes a new American process in which a strong circulation of air, supersaturated, is used. It is claimed that there is almost no loss due to evaporation.

There are many other abstracts relating to meat such as the "Quick chilling of meat," "Studies on beef quality" and "Chain freezing of meat."

A lengthy abstract deals with new developments in the freeze-drying of meat.

A number of abstracts relate to fish. One from Australia reviews the general question of the refrigeration of fish. Another from the U.S.S.R. deals with the thermal study of the process of air blast freezing of fish.



The storage of citrus concentrates at low temperatures is the subject of a paper from Spain. Refrigerating plants in the malting industry, in which the author shows how the use of refrigeration leads to decrease of cost and more even quality, also that the output capacity is increased 50 per cent., are described.

Three abstracts deal with canned food and cooked dishes. One with turkey dinners and turkey pies another with dietetic frozen dinners.

Under regulations and standards is an account of proposals for an international designation of halogenated hydrocarbon refrigerants.

In all there are 179 abstracts.

The *Bulletin* contains a catalogue of films and strips on refrigeration which will be of great value to teachers and lecturers.

Reviews are given of a number of books recently published.

Meetings of Commissions 2 and 7 at Prague in September

COMMISSIONS 2 and 7 held meetings in Prague in September; some were joint sessions and others meetings in their own right. A total of 19 papers were read and discussed.

In Commission 2, attention was directed to papers on the properties of insulating materials; methods of measuring thermal conductivity; anemometer for low air speed; transient heat flow as associated with water vapour movement; distribution of materials of known conductivity.

Commission 7, had as its principal topic refrig-

erated transport by road and rail vehicles and the testing of same.

It has been found that vans after long periods of service, when tested by the internal electrical heating method, give results in disagreement with the internal cooling method. This is ascribed to the drying out of the insulation during test.

During the period at Prague a number of interesting excursions were made to a dairy plant, a brewery, and the Research Institute for Refrigeration and Food Engineering.

The planning of the meeting was in the able hands of Dr. Ibl, director of the above-mentioned Institute.

A full account of the meeting will appear as a publication from the International Institute in due course.

Refrigeration Patents

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the *Official Journal of Patents*, and are published by permission of the Controller of H.M. Stationery Office.

APPLICATIONS RECEIVED

September 8—Refrigeration & Air-Conditioning Engineering, Ltd., Fowler, K. J. V., P28711, P28713, Ventilating apparatus. 9—Rhodes, P., P28890, Refrigeration apparatus. 16—English Electric Co., Ltd., Jonker, W. A. A. J., P29579, Temperature control system; Wilbushewich, E., C29531, Foodstuffs, etc. cooling apparatus. 18—General Motors Corporation, C29905, Refrigerators. 22—Garrett Corporation, C30238, Temperature control apparatus. 24—Electrolux Ltd., C30487, Absorption refrigerating apparatus.

COMPLETE SPECIFICATIONS RECEIVED

September 24—Brandi, O. H., 804,555, Air heating or conditioning systems; Stempel-Hermetik G.m.b.H. 804,748, Electric motor driven compressors for hermetically sealed small refrigerating units; Ansel, H. R., 804,690, Ice cube tray. October 1—British Oxygen Co., Ltd., 804,944, Process and apparatus for the low temperature separation of air; Westinghouse Air Brake Co., 804,894, Anti-freeze device for pressure fluid conduits; Brodrene Gram A.S., 804,870, Apparatus for the cleaning of freezing pockets of machines for the freezing of cream into solid

bodies. 8—Birmetals Ltd., and English Electric Co., Ltd., 805,261, Heat-exchangers; Hussmann British Refrigeration Ltd., 805,286, Means for automatically dissipating the water derived as a result of de-frosting the evaporator of refrigerating apparatus; Hussmann British Refrigeration Ltd., 805,210, Refrigerating cabinets.

CONVERSION IN BEDFORD

(continued from page 1114)

Johnston are concerned. An interesting point here is that although most of the produce in these cases is unquestionably for self-service, staff are always in evidence behind the refrigerated run to assist customers in their choice or to serve them from the extensive range of cheeses on show and also to keep the display well stocked from the built-in storage compartments to the rear of the refrigerated run. Frozen foods, too, are very much in evidence; there are two frozen food cases to match up with the 36-ft. run. Refrigeration also plays a very important part in the Continental foods section and the fruit and vegetable section, where there is a 12-ft. cabinet entirely devoted to the self-service display of pre-packed fruit and vegetables.

"Make Your Own Climate!"

Health Benefits of Air-Conditioning Have Only just Begun to be Recognized

By Dr. W. SCHWEISHEIMER

SOME people suffer more from hot days and heat waves while other people can stand them well. Of course, those are well off who have the blessed chance of working, eating, resting, sleeping in sensibly air-cooled rooms during excessively hot days.

A drastic change of temperature is of no avail. Twenty degrees (F) below outside temperature may be pleasant and there is hardly any danger of catching cold. The cool atmosphere and the resulting cool poise of everyone living and working in an air-conditioned room are good for the nerves of the inmates as well as for their hearts.

Saving Your Heart

There is less strain on the heart in air-conditioned rooms. The heart has more work to do on hot days. Air-conditioning eases the strain.

Here is an example how things work out in everyday life. A New York banker, 57 years of age, had a severe attack of coronary disease during an extremely hot month of June.

The coronary arteries are those most important arteries that feed the heart itself to keep it in efficient shape and function. When the banker was well again, after a few weeks of rest and treatment, his wife did not want him to return to his work during the summer months; she made reservations for him and herself in a resort place in the mountains where pleasant day breezes and cool nights could be expected.

However, Mr. W., the banker, had to go on working in New York, heat or no heat, he could not leave without serious damage to his business. His doctor prescribed two air-conditioning units for him—one in his office, one in his private bedroom. The prescription was carried out. No heart trouble occurred any more to the hard-working banker despite a prolonged heat-wave late in August/September.

Two Comfort Zones

People are less tired in air-conditioned rooms. Heavy sweating, a necessity on hot days and one of the body's foremost defences against heat damage, increases fatigue as a side effect. Air-

conditioning prevents this kind of hot-weather fatigue.

For a long time the so-called "comfort zone" was important for the construction of buildings and homes. This term means that particular zone of temperature, humidity, air motion and mean radiant temperature within which the inhabitants of rooms and houses feel well and comfortable.

Research work of the last few years, carried out at the research laboratories of the American Society of Heating and Ventilating Engineers, has produced more knowledge regarding the particularities of the comfort zone. First, it has established the important fact that in temperate climates such as ours there is not just one year-round comfort zone, but there are actually *two comfort zones*.

One of them, valid for summer time, is averaging 71° F., while the comfort zone for winter is averaging 66° F. Consequently the air-conditioning engineer has to set his thermostat and humidostat twice during the year; once in summer and a second time before winter arrives.

It has been shown previously in regions with warm climates that the attempt to set the temperature of air-conditioned movie houses at 70° the whole year round actually brought vehement protests from the majority of moviegoers, and eventually reduced the frequency figures of the movie theatres. When, however, engineers in Manila in the Philippines set the indoor temperature of the movie theatre always a few degrees below whatever temperature was outside, everybody felt fine in the theatre and was attracted by it.

An air-conditioning expert, Zulma Steel, has stated that in the United States the summer comfort zone of warm-humid New Orleans is four degrees higher than that of breezy Chicago or Pittsburgh.

In any city, north or south, summer conditions demand that as the outside temperature rises or falls, so must the artificially induced weather within the house. You cannot refrigerate human beings, Mr. Steel says, as though they were but a carload of California lettuce. A consulting engineer expresses his experiences with air-conditioning in these words: "The proper indoor temperature is one of which you are not conscious."

The problem an air-conditioning engineer or a building engineer has to cope with during the hot summer months, is clear from this comparison: an office worker requires an effective summer temperature of 67° F. to feel comfortable, while a charwoman scrubbing the floor of that same office will feel uncomfortably warm already with a temperature above 58° F. To find the proper

medium temperature and proper humidity in homes, offices and buildings needs a high amount of experience.

People are more efficient and productive in air-conditioned rooms. Some statistical figures indicate that at a temperature of 85° there is a 10% loss in working efficiency; at 90° F., there is a loss of 22%; at 95° F., there is a 38% loss in efficiency. As experience shows, increased heat increases accidents, cuts productivity.

Satisfactory air-conditioning, from the standpoint of human comfort and health, depends upon a number of factors. They have been listed by Allen, Walker and James as follows: Air supply and distribution—this is the basis of ventilation; temperature, humidity and air motion—these are interrelated, and their combined effect is expressed by what we understand under effective temperature; radiation may be an important factor under some conditions; odours, dust, bacteria, injurious substances—these factors may be said to determine the purity of the air. No system of air-conditioning should be designed without considering these factors.

Air-Conditioning and Hay Fever

That air-conditioning is not identical with air-cooling, as is assumed by a good many people, is obvious from its use for the treatment of hay fever and related conditions.

Hay fever is an allergic condition with inflammation of the mucous membranes of nose and eyes, resulting from specific sensitivity to certain foreign substances, mostly the pollen protein of plants. Hay fever usually recurs each year, the time of the attack depending upon the time of flowering of the plant or grain.

People who suffer regularly from hay fever and related allergic conditions, are helped by air-conditioned rooms. The filter in air-conditioners can keep out pollen. The cleaner air also removes dust which is irritating to a person's mucous membranes in nose, throat and bronchi.

Mrs. A. C. B., the wife of a Chicago businessman, had exhausting attacks of hay fever every year starting at practically the same day in June and going on for about six weeks. Quite a few doctors advised several methods of treatment, but none of them had any success. Mrs. B. was compelled to flee her home and the whole region of Chicago every year in order to avoid those distressing attacks of hay fever. Every year in June she went to a resort-place high in the Rocky Mountains where at that period of the year no plants were flowering which had those irritating pollens.

Eventually her home in Chicago was air-conditioned and this was enough to keep the irritant pollen away from her. She stayed in her rooms as much as possible during the critical

weeks, she went out only after a welcome rain had cleared the air of the irritant pollen, and all in all had a most happy time since during the whole flowering period she had hardly any attack of hay fever.

Air-conditioning of residences may bring also relief to some forms of asthma (shortness of breath) which are produced by certain allergic conditions. There is no doubt that nervous irritation is less in air-conditioned rooms, parents are milder and children less irritable.

The *Journal of the American Medical Association* recently has discussed the use of airfiltering systems in the treatment of hay fever. A New Jersey doctor had been consulted by one of his patients as to the advisability of installing a window air-conditioning unit in her bedroom. He wanted to know whether there was any particular unit the *Journal* would recommend.

One cannot expect too much from air filters, of course, according to the *Journal's* advice, if the patient does not stay in the air-conditioned room. It is well known that in the case of pollen and mould spores which often produce hay fever, most of the exposure occurs during the daylight hours. The effectiveness of the air-conditioning apparatus to a large degree depends on the patient. If he is willing to stay in the air-conditioned room the greater part of the twenty-four hours, the results can be much better.

Fans or Air-Cooling?

A fan can cool only those body areas exposed to the wind and only by evaporation of sweat. A fan cannot give too much relief from the heat since it only moves the present warm air. Experts have stated that, in the absence of body chillings, air cooling is a much more effective method of promoting comfort in hot weather than is the use of fans. Neither method is dangerous when chilling can be avoided.

In the early years of summer comfort cooling, many buildings were grossly overcooled, and the entire air-conditioning trade was widely discredited. There are still instances of overcooling, as mentioned by Allen, Walker and James, but operators generally have come to realize that although 70° F. may be comfortable with winter conditions and winter clothing, it is not comfortable in a theatre or store in summer. The secret of life with successful air-conditioning is not to overcool a room.

Complaints about cooling or chilling effects of air-conditioning are much less frequent to-day than in those early periods. Proper adjustment of the air-conditioning equipment will make complaints about getting colds in an air-conditioned room disappear.

(Continued on page 1125)

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C.17

Air-Conditioning a West End Banqueting Suite

WHEN, nearly five years ago, the plan for a banqueting suite as part of the existing restaurant business of Quaglino's first took shape, those responsible began with the great advantage that they could start with bare ground. They had no existing building to convert or to adapt with all the limitations that that can impose.



Quaglino's new banqueting suite. A view of the ballroom taken through the entrance doors showing the mirrors with their Spanish hand-carved gold leaf gilded, wooden frames on the north wall, and the Spanish chandeliers which set the motif for the ballroom.

The construction of the modern office block on the bombed site, adjoining their premises at the corner of Bury Street and Jermyn Street, provided them with all the accommodation they required to build this fine new banqueting suite which "M.R." inspected recently.

Because a number of famous establishments specializing in banqueting business closed down in the years since the war, the West End of London has suffered for a number of years from an acute shortage of banqueting accommodation. The new premises should therefore fill a long felt want.

To provide a very high standard of service and cuisine for which Quaglino's have always been famous, it was necessary to construct the banqueting kitchen and all its ancillary services on the same floor and immediately adjoining the ballroom, so that each dish can be served immediately it reaches the perfection of the chef's art. No stairs to be climbed by the waiters bearing the food—no lifts bringing the food from below—

just a wide and brief corridor leading direct from the hot plates into the ballroom.

When any number up to 400 people are being served in one banqueting room their enjoyment is so often marred by the temperature in the room—it is too hot, too stuffy, too smoky, sometimes even too cold.

Quaglino's are pioneers in air-conditioning—the restaurant was the first fully air-conditioned restaurant in London long before the war.

In the banqueting suite—as in the restaurant—the air is fully conditioned—washed, excess humidity extracted, heated or cooled—to provide the ideally comfortable temperature and the right degree of humidity required for each occasion.

The plant can provide 800,000 c.ft., or 26 tons,

of conditioned air per hour; more than sufficient to provide a comfortable atmosphere for 500 guests and staff.

The system provides conditioned air for the whole of the banqueting suite by introducing, at high level, conditioned air at a constant temperature, and extracting at low level.

The air is drawn through the main filter chamber, which has a 70-sq. ft. filter bank, into a large air cooler, manufactured especially for this particular scheme. This cooler is capable of transforming 13,000 c.ft. of air per minute, from 85° F. dry bulb (70° F. wet bulb) to 52.5° F. dry bulb (51.6° F. wet bulb) using "Freon-12" refrigerant gas.

Following the cooling coil is a low pressure steam air-heater which provides reheat after dehumidification and direct air heating when necessary.

The cooler and heater coils are incorporated in the main ductwork as a unit within a tank specially

constructed to trap and dispose of the water during dehumidification.

The air supply to the banqueting suite always exceeds the extract and this excess provides the foyer with its supply of conditioned air. The foyer has under-floor heating for added comfort in winter.

The whole air-conditioning system provides eight air changes per hour in the ballroom, nine per hour in the reception room and 10 per hour in the smaller rooms and staff rooms. The kitchens, which have their own control panel, have 30 air changes per hour.

The system maintains ideal conditions by a varying volume of air at constant temperature, and not, as elsewhere, by a constant volume at varying temperatures. This method avoids the cold draughts usually associated with a rising room temperature.

Main plant control is through an electronic panel, which has a master thermostat in the air supply duct to determine the air condition.

Three further thermostats in the filter chamber decide whether summer or winter conditions exist—the factor being the actual temperature and not the time of the year!—and select the degree of summer or winter air supply compensation to be given to the suite.

Warming is effected by opening an automatic steam valve on the heater battery and then cutting down fresh air in favour of recirculation. Cooling is provided by controlling the ratio of fresh air to recirculation.

Humidity is controlled by cooling the air until condensation occurs, removing moisture from the air, and then reheating the air to the desired temperature.

Perishable food in the kitchens of the banqueting suite is kept fresh by the use of two cold rooms, one for the large quantity of meat that is used and the other being used as a general purpose room.

The meat coldroom, which has a deep-freeze compartment installed in it for the storage of prefrozen foods, has a capacity of approximately 1,700 c.ft. and a temperature of 28° to 32° F. is maintained by a 1½ h.p. water cooled condensing unit in conjunction with two unit coolers which are suitably mounted on the ceiling of the store to ensure an adequate air distribution throughout the room by means of a fan on each cooler. These coolers are automatically defrosted twice a day by means of water which cascades over the cooler thus melting any ice that has accumulated.

The room itself is insulated throughout with slab cork and finished on the inside with stipple glazed asbestos sheeting for durability, whilst the floor is covered with terrazzo-tiles to enable the store to be kept scrupulously clean by hosing down with water. A full complement of ceiling

and wall rails are provided together with slatted wood rack shelves along one wall.

So that selected fruits and vegetables can be served at any time of the year whether they are in season or not, or unexpected demands may be met more easily, the cold room includes a 30 c.ft. deep-freeze compartment which is held at a temperature of zero °F. for the storage of up to 900 lb. of prefrozen foods.

The deep freeze section has a special coiled liner and is cooled by means of a ¾ h.p. water cooled condensing unit.

Similarly constructed, the general purpose coldroom has a capacity of approximately 1,150 c.ft. to maintain it at a temperature of 34° to 38° F. a ¾ h.p. water cooled condensing unit is required together with one unit cooler, ceiling mounted. Due to the higher room temperature, no special defrosting facilities are required since it defrosts itself on the "off" cycle.

The three condensing units together with the necessary controls, etc., are housed in a special engine room designed for this purpose and situated adjacent to the coldrooms.

This up-to-the-minute installation embodies the very latest developments in refrigerated storage and ensures absolutely safe protection of all perishable foodstuffs under the most hygienic conditions.

Refrigeration plant for air-conditioning—L. Sterne & Co. Ltd.
Refrigeration plant for food storage—Metropolitan Refrigeration Ltd. with York equipment.

AIR-CONDITIONING AND HEALTH

(continued from page 1120)

The problem whether people living in air-conditioned rooms are less inclined to colds, has not yet been solved. As a rule colds do not come from air-conditioning properly installed and controlled, although some people may feel temporary congestion or nasal drip as a result of breathing chilled air. A. D. Brandt mentions that one study in a large office building has indicated that there is no significant difference in the frequency rate of illnesses between occupants of air-conditioned and non-air-conditioned buildings. Others have reported considerable reduction in the illness rate through air-conditioning.

British Pavilion for Olympia.—The British Pavilion at the Brussels International Exhibition, of which the Duke of Edinburgh, when he visited Brussels in July said, "I wish everyone at home could see it," is to be brought to London and shown throughout the four weeks' run of the *Daily Mail* Ideal Home Exhibition, which opens at Olympia on March 3, 1959.

The Freezing of Fish for Industrial Purposes

By A. BANKS, Ph.D., F.R.I.C., and G. C. EDDIE, B.Sc., A.R.C.S.T., A.M.I.Mech.E.,
A.M.Inst.H. †

Torry Research Station, Aberdeen, Food Investigation Organization,
Department of Scientific and Industrial Research

● The authors describe their work on the development of industrial packs of frozen fish from 30 to 100 lb. in weight. The latest economic assessment of the *NORTHERN WAVE* type of freezing trawler is stated. The economic roles of the consumer pack and the industrial pack are discussed; the authors do not believe that consumer packs of fillets are the only commercially useful form of quick frozen fish. Various technical points in the current practice of freezing, storing and thawing industrial packs are discussed, with brief accounts of the work in progress at the Torry Research Station. The authors are of the opinion that storage in jacketed stores at minus 20° F. (-29° C.) will prove to be more effective and economic than storage at higher temperatures with wrappers or dips of any kind other than an ice glaze. There is a need for exchange of information on practical methods of constructing jacketed stores

THIS paper discusses the development of projects for quick-freezing fish in slabs ranging in weight from about 30 to 100 lb. (15 to 50 kg). These large packs are not intended to be sold to the consumer but to be thawed, and in many cases further processed, at some intermediate stage in the chain of distribution. For this reason they may be called industrial packs, to distinguish them from consumer packs. In this sense consumer packs include not only wrapped frozen fish for retail sale to individual consumers but also packs of up to about 14 lb. (7 kg.) in weight for use in hotels, restaurants, ships and so on.

The production of industrial packs of frozen fish has been studied at the Torry Research Station for two applications: the freezing of white fish at sea in large trawlers of orthodox type, and the cheap freezing of drift net herring in bulk on shore. The first of these developments has been tested and proved technically on the full scale in a commercial steam trawler, the *Northern Wave*, and full accounts of this experiment have been published[†].

In the United Kingdom some fish is already frozen for industrial purposes in shore establishments. There has, however, been some tendency to regard industrial packs of frozen fish as not coming properly within the category of "quick frozen food" because as usually understood in the U.S.A., Canada and the U.K., this means food quick-frozen for sale to the public in the form of consumer packs. It is believed however that other functions can be served by quick-freezing and low temperature storage besides the provision of a new range of consumer goods, and that the procedure in certain cases could effect considerable economies in the industry. That these potentialities have been relatively little explored in the British fish industry is probably because the quick-freezing of fish has undergone development parallel to that in the U.S.A., consumer packs of fish being prepared to a great extent in shore factories also producing similar packs of other foodstuffs. Equipment for freezing small packs on land did of course become commercially available some years before the type of plant described below.

The U.K. can claim one of the first and still one of the most successful examples of industrial freezing, viz., the trade in frozen mutton and lamb from New Zealand. This is thawed and dis-

† Text of paper presented on September 3 at a joint meeting of commissions 3, 4 and 5 of the International Institute of Refrigeration in Moscow.

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tributed for sale in butchers' shops in the same way as fresh meat. Australian beef is also handled in this way as well as by chilled gas storage. In these cases the trade has used refrigeration to solve its technical and economic problems internally and without attempting to produce a new range of frozen consumer goods.

It is interesting to note that much of the quick frozen food sold in France is sold after thawing¹³. In this case, however, it is probably a matter of consumer preference.

In spite of examples to the contrary the argument is still put forward that unless consumer packs are produced, freezing will merely add to the expense of the product, without adding a corresponding amount to the consumer-appeal. It is true that the actual processes of quick-freezing and low temperature storage are expensive and if they are applied to an already existing article of trade such as iced fish, or chickens, the final price is almost bound to be higher. There must therefore be compensating advantages. In all but the largest countries the degree of further spoilage which can be prevented by freezing during the journey from the port to the consumer will be slight—although with perishable foodstuffs like fish, quick-freezing can be and, unfortunately, sometimes is used at the ports to prevent condemnation by the authorities at the inland fresh-fish market. By and large, however, the consumer pack to offset the increased price must rely upon upon readiness for cooking and a guarantee of a certain minimum standard of quality.

The main advantage of the consumer pack is that the food is ready for cooking and there is little or no mess and no waste. This result is achieved at the cost of a good deal of processing and expensive wrappings. It is almost true to say that the primary function of the quick-freezing process, as developed in connection with consumer

packs, is to inhibit bacterial action in ready-prepared food during the time between processing and consumption. This can also be done by canning or by drying, but the resultant products often do not so closely resemble the "fresh" foodstuff as does the quick-frozen article. This is the real justification of the consumer pack in many cases.

Except in the largest countries it is possible to distribute all fish (above a certain level of quality at the time of landing) in the chilled condition. In the U.K., therefore, an advantage of the industrial pack is that it can be used as well as iced fish to supply the existing wholesalers and processors at the ports. The processed and packed fish can then be distributed in the chilled form along existing channels and there is no immediate necessity for an elaborate chain of cold stores for distributing the fish to the consumer who nevertheless reaps many of the benefits of quick-freezing. Even in the largest countries only a few entrepôts where fish could be thawed and repacked would be required.

The sea-frozen whole cod produced by the *Northern Wave* was handled in the manner just described. It was of very high quality and could be used for all purposes for which very fresh iced cod is used. Such fish could for instance be used to produce fillets for consumer packs.

Nevertheless, the possibility of producing consumer packs at sea is very attractive, and although costs would be higher than on land, these might be offset by marketing directly to the consumer. The vessel and the crew required for economic operation are very large, e.g. *Fairtry*⁸ and *Pushkin*. There is a size of ship below which it is probably more economical of space to freeze whole fish, at least in trawlers of orthodox design. With the advent of smaller filleting machines, and the general adoption of shelter decks and stern trawling, it is likely that the *Northern Wave* and *Fairtry* lines of development will merge at some time in the future, the final size of the vessels being determined by docks facilities and the lengths of voyage acceptable to the crews.

Even then, the entire catch may not be filleted, at least for consumption in the U.K., in spite of the savings in space and power accruing from the freezing of fillets rather than whole fish. A proportion of the British catch undergoes further processing in the form of smoke-curing, and it is our experience that good smoke cures can be produced with more certainty from frozen whole fish than from frozen fillets. This frozen whole fish would be produced as industrial packs and the final products would be delivered in the chilled state as at present.

If fish is quick frozen at the correct time and place, as in the cases just quoted, and stored

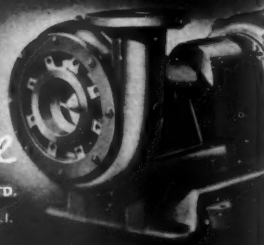
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properly, the consumer will be presented with a better product than the normal and may be willing to pay more for it. However, the savings made possible by intelligent application of freezing at the correct time and place may more than offset the extra costs of freezing, storing and thawing.

A study of the economics of the *Northern Wave* type of freezing trawler illustrates this point very well. In the *Northern Wave* itself, the size of the freezing plant and cold store was for very good reasons greater than had been recommended as the optimum, and the space remaining for wet fish was correspondingly smaller. The result was that no extension of the voyage beyond the usual limits was ever possible, and the frozen part of the catch would probably have fetched a fair price even if it had been iced. The ship produced roughly the same amount of fish during the experimental voyages as it would have done without freezing plant. Although the quality of the products was outstanding the experiment in itself was not an economic success for this reason among others. The cost of operating this type of plant is now known with some accuracy and it is possible to specify an installation suitable for an orthodox large trawler. It is still doubtful whether a steam trawler equipped to freeze part of the catch in this manner would be an economic success unless higher prices were paid for the frozen fish, at least if ships of much under 200 ft. b.p. are considered. But such a scheme still does not take full advantage of the economic potentialities of freezing. It has recently been calculated by one of us that a suitably equipped motor trawler of orthodox size and form but designed specially for the fullest possible exploitation of this method of freezing could produce whole gutted cod which after storage and thawing could be sold for the same average price as iced cod without loss to the producers.

One of the main advantages of quick-freezing and low temperature storage is that it can be used to preserve seasonal surpluses until times of scarcity. The production of consumer packs does not seem to serve this purpose very well, at least in the U.K. Fish are frozen in bulk for subsequent processing, and by and large frozen fish consumer packs are held in store by the producer for a few weeks at most. Even peas are frozen and stored in bulk, to be repacked in the off-season. The reason apparently is that it is uneconomic to provide packaging and other ancillary machinery on a scale sufficient to deal with the entire harvest as it occurs. This ideal is more or less achieved in *Fairtry* by maintaining a steady rate of catch whenever possible and by using a buffer store to smooth the fluctuations in supply to the factory.

In order to preserve the summer surplus until

the times of scarcity it is necessary to store for periods of up to eight or nine months. For this purpose it is necessary to use fresh fish, for if fish more than 1 to 7 days in ice depending on species is stored for nine months, even at minus 30° C. (-22° F.), and after proper quick-freezing, there will be a detectable adverse change. If the fish is to be smoke-cured it should be no more than one to three days in ice before freezing. There are therefore good reasons for supposing that the consumer pack produced at the fishing port from iced fish will ultimately not be the only product, or even the main product, of the fish-freezing industries of many of the countries exploiting the distant grounds from the Grand Banks to the Barents Sea.

Furthermore there are cases where the frozen pack of fully processed fish does not yield the best product. For instance, kippers can be frozen in both consumer and industrial packs, but while acceptable they are not of the very highest quality, as are kippers made from thawed frozen whole herrings. The same is true of smoked white fish. Properly smoked fish will keep at chill temperatures for a week in very good condition and are acceptable for up to a further week.

There is one instance, however, even in the U.K. where if the fish is to reach the consumer in really good condition it must be frozen. This is the case for fresh herrings caught round the Scottish coasts, which may not reach the consumer until three days² after catching, by which time they will have suffered considerable deterioration if merely chilled. Herring is a very cheap fish and cheap methods are required for freezing it, i.e. methods which eliminate hand packing and expensive wrappers. Bulk freezing would also be a solution to the scarcity of good quality herrings for kippering in winter.

There is therefore a good case to be made for the production of industrial packs of frozen fish at least for some purposes and in some countries and these remarks may serve as a reminder that the term quick-frozen fish is not necessarily synonymous with consumer packs.

Freezing Methods

The installation on the *Northern Wave* has been fully described³. Because it was not thought practicable to fillet on a ship of 185 ft. (60 m.) the gutted cod were frozen whole in slabs of 63 lb. (30 kg.); however, as explained above, there are advantages in freezing the whole fish, especially if there is already in existence an industry geared to the distribution of chilled fish in various processed forms. The main disadvantage is the space occupied by the freezers, and by the frozen whole fish, even when in the form of rectangular slabs.

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The space occupied by the freezers might be reduced in several ways. The blocks of fish produced on the *Northern Wave* were 4½ in. (115 mm.) in thickness. Most of the cod was frozen headless and it is now believed that provided this practice is adopted the thickness could be reduced to 4 in. (102 mm.) with a corresponding reduction in freezing time. If two operators were available at all times for loading and unloading freezers and stacking the blocks the weight could be increased to 84 lb. (40 kg.) or more.

The freezers were of the vertical plate type similar in principle to freezers used in Norway and New Zealand for whale meat. Loading was very simple, the fish making good contact with the plates by reason of their own weight. No wrappers were used, and because there was direct contact between the fish and the freezer plates there had to be a very quick-acting hot gas defrost system for the release of the frozen blocks. The plates were of a well-known embossed steel design, the refrigerant being "F-12" at minus 40° F., supplied by pump, but only in sufficient quantity to achieve dry expansion. Further development tests have since indicated that even with these thicknesses of fish an increase in heat transfer from refrigerant to plate as compared with the conditions just described can produce a very worthwhile improvement in freezing time. It is also believed that the performance of most contact freezers could be improved by better design of plates. Work on both these lines is in progress at the Torry Research Station. It therefore seems likely that the throughput per unit of space occupied by the Torry-Hall vertical plate freezers can be considerably improved, although the *Northern Wave* installation was itself notably compact, bearing in mind the thickness of the slabs produced, and that they were discharged from the freezer at a mean temperature approaching minus 30° C. (-22° F.).

The vertical-plate freezer, with a hot gas defrost arrangement permitting direct contact between fish and plate, is very suitable for freezing industrial packs with the minimum of labour, since loading is very simple. For a cheap method of freezing herrings that would retain high quality the vertical-plate freezer seems to have possibilities, since it is reasonable to expect that the herrings can be poured or piped into the space between the plates.

The quality demanded of frozen herrings in the U.K. is very high being equivalent to that of herrings less than 18 to 24 hours caught and iced at landing. In addition any softening in texture as a result of freezing and cold storage adversely affects the quality of the kippers produced from the thawed fish, as they have to pass through a machine which splits and guts them. The simple brine freezing process is inapplicable because of

the acceleration of rancidity. The methods employed are air blast which is generally held to be inherently more expensive than contact freezing because of space and power consumption; and the horizontal plate contact method which is liable to be expensive in labour.

Examination of the quality of herrings produced in vertical plate freezers has now been under way for two years. The freezer used produces rectangular blocks which are 33 lb. (16 kg.) in weight when 2 in. (50 mm.) thick. Such blocks after glazing and storage show less development of oxidative rancidity than well-glazed herrings frozen in air blast in single layers, presumably because of the reduced surface area for a given weight. However, present experience shows that somewhat greater damage may occur in the vertical-plate frozen herrings. This may occur in the freezer or, perhaps more likely, during thawing. Thawing of blocks of fatty herrings with thicknesses greater than 2 in. is especially difficult owing to the ease with which mechanical damage may occur when removing layers of herrings already thawed. This problem may be solved by improved methods of thawing, or it may be necessary to investigate the production of industrial packs by air blast methods in substantially single layers, the vertical-plate freezer being unsuitable for blocks less than about 2 in. (50 mm.) thick.

No attempt has yet been made to produce large slabs of frozen fillets or steaks in a vertical-plate freezer.


Thawing

Thawing frozen fish in large quantities in factories is a new problem which is introduced with the industrial pack.

The method adopted for thawing the 4½ in. (115 mm.) slabs of whole gutted cod produced on the *Northern Wave* was to circulate air slowly over the slabs at about 60° F. (15° C.). This is the highest air temperature that can be used with safety when the appearance of the thawed fish is important. Thawing is inevitably slower than freezing, both because of the reduced temperature difference and because of the lower thermal diffusivity of thawed flesh. The thawing process took about 18 hours. This would be satisfactory from the operational point of view as the probable amount of iced fish on the distant water markets is generally known about 48 hours in advance. Proposals have been advanced from time to time for tunnel thawing but as it is not permissible to increase heat transfer by further raising the temperature but only by increasing the surface coefficient it seems doubtful whether tunnels are economic for thawing such thick slabs.

Thinner slabs such as 2 in. (50 mm.) slabs of herrings can be thawed successfully in cold water

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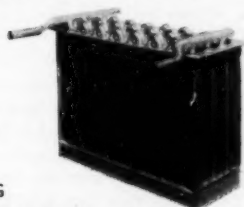
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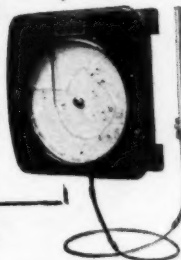
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if temperatures and times are carefully controlled ; this method is in use in at least one large factory when thawing industrial packs for further processing. Cold water thawing can be used judiciously during the early stages of thawing slabs of whole cod, but too much application of water makes the fish soft. A point is also quickly reached where the internal heat transfer in the block can in any case be maintained in slowly moving air.

The air-thawing method for slabs of whole frozen cod does involve the use of a fair amount of space, but this has been taken into account in the latest economic assessment of freezing whole cod at sea which was referred to above.

The methods of thawing just described are intended to produce fish which are in every way comparable with iced fish, and this they do with a high degree of success. The best result of all is achieved by thawing for a certain time, then immersing the partially thawed slab in ice. The thawing is continued long enough for the heat content of the slab to be just sufficient to complete the thawing at the centre as well as to supply the losses from the outer layers to the ice. In this way

the time for which the surface temperature is near 60° F. is kept to a minimum.

The authors have been associated with laboratory trials of other methods of thawing that have promised higher performance. In the case of thawing by infra-red radiation standard lamps raise the surface temperature of the slabs ; it may be possible to find a wavelength with the correct degree of penetration but this has not been done. Electric resistance thawing is unstable and so far has been found to be uncontrollable. At present experiments are proceeding on dielectric heating methods, which will not be entirely free of the same faults.

Cold Storage

The very high quality of the sea-frozen cod from *Northern Wave* even after several months of storage was in no small measure due to the adoption of a storage temperature of minus 20° F. (-29° C.) both on the ship and on land¹⁰. It is also well known that herrings can be kept free of significant oxidative rancidity and other changes for several months if stored at this temperature³. Most new stores for frozen fish in the U.K. are now designed for minus 20° F. (-29° C.).

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It is our experience that the use of well-designed cold stores at minus 20° F. along with a simple glaze of water ice is easier and more effective than the use of higher temperatures in association with various dips, anti-oxidants, gels or wrappers, even on a small scale, and this will certainly be the case with industrial packs amounting perhaps to several thousands of tons. Such information as is available to us about the costs of operating cold stores suggests that the difference in costs between a store designed for -20° F. (-29° C.) and a store designed for -5° F. (-20.5° C.) is relatively small, and if the cost of dips, wrappers, etc. is added it is possible that the lower temperatures may be more economic.

Nevertheless, the costs of cold storage form a fair proportion of the costs of quick-freezing and it is desirable to reduce them. This may be done by new forms of construction and by a new basic design, referred to below.

Desiccation in cold store is one of the biggest technical problems connected with frozen food-stuffs, and it is of course also a problem of considerable economic importance. Desiccation in conventional stores is least in those stores properly designed 'or minus 20° F., but for storage over long periods reglazing is still necessary. When considering several thousands or tens of thousands of tons of frozen fish in industrial packs, to be stored perhaps for nine months, perhaps the most sensible method of solving the problem would be the adoption of jacketed cold stores at minus 20° F. (-29° C.).

The biggest problem in the construction of a jacketed store would seem to be the effective sealing of the jacket space from the room. So far most of the experience of building large cold stores on the jacket principle has been confined to Russia and Canada.^{6 7 8 11 12} The rapid and complete exchange of information on the construction of such stores is probably one of the most important steps that remain to be taken in the practical development of quick-freezing.

Jacket construction may well cut cold storage costs. As one of us has pointed out⁴ the thickness of insulation used on stores of orthodox construction are far greater than are indicated by a simple analysis aimed at finding the minimum annual costs of machinery and insulation combined. This is because desiccation has to be reduced to an acceptable level. With jacketed construction, insulation thickness and costs may well be reduced to a more economic level.

Conclusion

Quick-frozen fish does not simply mean con-

sumer packs of fillets, fish sticks and the like. Quick-freezing could be used, for instance, in the British Arctic cod fishery, to produce whole cod in the thawed state more economically than if the trawlers relied upon ice alone. This fish is equal in every way to very fresh iced cod. Thawing methods for industrial packs are adequate but more rapid methods would be convenient and would save space. Cold stores of jacketed construction operating at minus 20° F. (-29° C.) would not only insure against changes in quality and weight over periods of several months but might prove more economical to construct and operate. Exchange of information on the construction of jacketed stores is very desirable.

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